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HABITS CAN MEAN TROUBLE

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SUPPOSE you saw a child in the water, suppose you heard that child cry for help, would you say to yourself, "That child can swim, the water is not over his head, it is not too deep, if he can't swim, he can stand up." Or, would you say to yourself, "Why take any chances? Maybe he can't swim, and maybe the water is deep."

If you ignored the child he could easily have drowned. If you went to his rescue and you found he really was in trouble, you saved a life. Or suppose he was just a little boy calling "Wolf," did you really lose anything by trying? *No,* emphatically, *NO!* And yet many orthodontists and pediatricians advise parents to disregard habits or troubles in young patients, as they are supposed to outgrow them. How wrong can one be? Is it because they do not have effective ways and means of controlling these habits or troubles?

It is possible through a little *hard work* in your office to get enough accurate and true information and facts concerning these habits and muscular perversions to benefit our patients and the orthodontic profession as a whole. *It is* of paramount importance to all of us to know why malocclusion is becoming more prevalent in spite of our increased knowledge and research work. Ideas which bring about improvement sometimes have to wait upon other ideas before they count. The orthodontic profession has made great progress in diagnosis, but further progress depends on the development of new ways to explore, not just the oral cavity, *but the human being as a whole.* Each individual and each individual project takes time and more time, *a fact which we all should realize lest we become discouraged and stop too soon.* We should not be too quick to reject any ideas and suggestions which might seem trivial. We must all strive to improve.

Orthodontics, similar to other healing arts, has been wavering back and forth between extremes of thought. Our most recent swing on the pendulum has been toward the idea that if teeth were properly aligned over the basal bone, stability would result. At present this idea is being soberly tempered

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by the realization that function and environmental conditions, as well as hereditary factors, are extremely important. Of the more or less controllable environmental conditions which influence the position of teeth, *habits and muscular perversions are paramount.* The balance of muscular forces which stabilizes all dentures, either in good occlusion, or malocclusion, is greatly influenced by habits. Those habits which concern the orthodontist are those actions or conditions related to the oral cavity which, *by constant repetition, become spontaneous.*

Nail biting, thumb-sucking, lip biting, mouth breathing, tongue protrusion, and all other detrimental oral habits usually are just a reflection of something more serious, and should be treated as such. The orthodontist who wants to discover the cause must first know much more about the circumstances under which the habit first developed, for how long a period of time it has been going on, whether nervous tension, overfatigue, boredom, hunger, improper feeding, improper feeding conditions, jealousy, lack of attention, too much attention, unhappiness, or perverted muscular use is causing the habit or habits. According to most of the literature on this subject, the main and basic cause of these perversions is a feeling of insecurity. Treatment should begin with the removal of the causes of the tensions responsible for the origin and maintenance of the habit. A complete history should be obtained in order that we may find the *original* cause of the trouble and prevent a recurrence, once it has been corrected.

Almost one hundred years ago, J. Irmie gave thumb-sucking as a possible cause of irregularities of the teeth. He remarked, "Irregularity is due to want of development of the jawbones, intemperance of various kinds, combined with artificial modes of living introduced by civilization, and sudden transition from heat to cold to which teeth are subject." The first attempt to corroborate Irmie was that of Thomas Ballard, who, in a paper on the "Constitutional Ill-Effects of Fruitless Sucking and the Diagnostic Value of Deformed Jaws in Relation Thereto," which was read before the British Odontological Society in 1864, claimed that "in idiots are seen the worst forms of defective growth, so also do they exhibit the most aggravated forms of deformed jaws and teeth; the habit of sucking being retained by them to an advanced age."

Now, would it not be interesting to all of us if we could know how many of the so-called retarded children are so termed because of their extreme facial deformities and abnormal habits which influenced or caused the deformity? Could it not be possible that many of these habits need never be allowed to develop, because any habit which grips a child has so many conflicting foundations that all orthodontists should be eager to know as much about the subject as possible and see in what way we can help *that* particular child, and what may be amiss in *that* particular family. Actually there is no need for any real conflict between orthodontists and psychiatrists. They can mutually benefit each other.

Dr. James D. McCoy stated, "One of the most potent and far reaching causes of malocclusion is to be found in certain habits involving muscular

forces in and about the oral cavity, the forces alluded to being HABITUAL AND FREQUENT MANIPULATION OF THE LIPS, TONGUE OR CHEEKS IN A MANNER AT VARIANCE WITH THEIR NORMAL USE. FORCE, THUS EXERTED, THOUGH IT BE GENTLE, WILL CAUSE THE TEETH TO ASSUME AND MAINTAIN DEFINITE POSITIONS OF MALOCCLUSION WHICH WILL BE CHARACTERISTIC OF THE MUSCULAR HABITS PRODUCING THEM." I am sure you will all agree that *prevention* is more important in our work than correction. The significance of this cause, while recognized by orthodontists of experience, is often overlooked by those less experienced, for these habits operate so quietly and are so unconsciously performed that even the patient is frequently unaware of their existence. Indeed, the treatment of many patients is carried to completion only to result in eventual failure because of the fact that such a habit or perversion of muscular function remains unchecked and uncorrected. Further, it is highly important that this factor should be discovered and made known as early as possible in our association with the patient, for if allowed to go until the case is near completion, IT WILL OFTEN BE INTERPRETED BY THE PARENT AS AN ATTEMPT TO ESTABLISH A POSSIBLE ALIBI IN CASE OF FAILURE.

Dr. Strong stated:

"When any habit is found to be an etiological factor in a case, it is well to have the child demonstrate the act, for it is only by seeing the tissues in process of being molded under the influence of the muscles in faulty or excessive contractions, that the operator can intelligently analyze the forces at work and fully appreciate the great importance and necessity of absolutely removing this cause as part of treatment, if stability in the ultimate result is to be expected."

Psychiatrists and pediatricians know that emotional experiences during the first years of life are of paramount importance, not only because of their influence on mental health in later life, but also because of their effect on the oral and physical development and health as well. This is a formative period when deep-seated problems may be created, and it is during this period that they may be minimized or avoided through increased knowledge on our part.

Ordinarily there are two general causes which produce habits. One is the precipitating, and one is the underlying. Always, however, the root causes can be traced to infancy or early childhood to the effect of the environment upon the child and his reaction to it. A child can be spanked and injured bodily until he is black and blue, without having any effect upon his ceasing a habit! Inasmuch as the infant, up to approximately 5 years of age, does not appreciate pure mental gratification, or does so only to a negligible degree, practically all of his life he is dominated by the way his body feels. The infant does not care whence his pleasures are derived. He is decidedly self-seeking and pleasure seeking. He takes in everything and gives practically nothing. Strangely enough, parents can do equally as much harm to their children by fussing too much as by fussing too little. Every child must be studied and treated as an individual. Common or horse sense must be used.

In the same way most rules of mental health would be framed in the negative: *Don't pamper the child; don't make him jealous; don't worry him or worry over him;* and *don't say "don't" all the time. Don't show favoritism, don't humiliate him.*

If a psychiatrist did not believe that the blemishes of personality could be to some extent erased, or corrected, or, better still, prevented, he would surely give up the practice of psychiatry. Would not the same rules apply to us as orthodontists? Surely we can help erase, correct, or prevent much of the damage that is done by habits before the patient becomes a case for a psychiatrist.

When these habits have taken hold, one important phase of treatment is to determine what we can substitute that is less harmful than the present habit. If we go about correction of these habits in the proper way and use the proper strategy, we can usually eliminate them. A basic principle of psychiatry is a substitution of something higher for something lower. This holds especially true where there is a marked inferiority complex which is sometimes the cause of the habit.

Seeing new people and new faces can easily change the emotional setting. It is my humble opinion that the answer to many of the problems of children would be a change of parents, but this, obviously, is not practical, so we can at least try to make a partial change in their environment. We may also help substitute innocent habits and pleasures for more damaging ones. We must have an imagination in working with these habit patients. What about the cause and effect—what if they were transposed? There is much confusion about matters that should be scientific. A true and accurate case history illustrates why it is well to think in terms of transposing cause and effect, of asking of an apparent effect, "Is this the cause?" or asking of an alleged cause, "Is this perhaps the effect?" By challenging sequence, we can often break the vicious circle. The effect of being overtired can be thumb-sucking, and the patient cannot go to bed without his thumb in his mouth and cannot sleep without it. This effect then becomes a cause. Obviously we can help change all of that by changing the first effect. We could help educate the parents not to let their children get overtired; they would then be better able to relax without the aid of their thumb as a pacifier. Since cause and effect are not always immutable, it is always well for us to delve into other possible causes. We can give these patients an incentive, and we do not mean by bribing, but an incentive for a better-looking mouth, cleaner nails, and doing away with habits which are repulsive and cause for their being made fun of by their playmates. Even a very young patient finds buck teeth something to shy away from or make fun of. Sufficient models and photographs to illustrate what a habit might result in are of great help.

Do not set yourself up as the ideal person who never had any bad habits. We have found that by telling about habits which we had and were able to overcome, we were able to obtain better cooperation from the patient. If the truth be known and we carefully analyze ourselves, we would find that while we may not chew on our nails or suck our thumbs, we probably do have

some mannerism which we are unaware of and which we could correct. In aiding some of the adults of tomorrow, we may indirectly aid ourselves. Just notice some of the fingernails of members of our profession at the next dental meeting.

Surely we realize that the practical application of our training and knowledge, to be effective, *must be directed toward the education of the parent.* We have found that the instructions to parents should be *methods of prevention* and *methods of correction.* Both of these groups can be further subdivided into positive methods, i.e., *things to do;* and negative methods, i.e., *things not to do;* and things *not to do* are the more important.

Open-bites are one of the most difficult of all orthodontic problems to correct. They are of two main origins: (1) those which progress from a poor skeletal pattern; (2) those which are caused by a perversion of the function of the tongue. It is the latter that we are concerned with in this article. At this point I would like to stress that *the time to correct an open-bite is before an appliance is placed in the mouth.* How, you may ask, do you propose to do this? After examining quite a few patients with open-bite, we found that a large proportion of them had no gag reflex or the gag reflex was greatly diminished. We believe that many started swallowing incorrectly during the nursing period because a nipple which was too long and too easy flowing was used. The infant did not have to suck or exert any pressure on the nipple and therefore never found out how to raise the posterior part of his tongue. Those whose gag reflex is lacking or diminished do not know what it should feel like to swallow normally. Some develop tongue perversion following tonsillectomies probably due to injury to the sensory nerves in the faucial area. Whatever the cause may be all of these patients need retraining. They have to be taught to swallow correctly. They have to be made to know what it feels like to swallow properly.

To accomplish this we have them hold a small piece of a candy Life Saver on the posterior part of the tongue and hold it up against the posterior border of the hard palate. They do this constantly until they know where the tongue should be placed in swallowing. When this has been accomplished the bite will close, and if the patient had a lisp before it will disappear also.

SUGGESTED PREVENTIVE METHODS TO USE

1. Work more closely with the pediatrician and have him feel free to send in young babies who do more than the usual amount of thumb-sucking. Educate pediatrician and parents regarding types of nipples to use and allowing ample sucking time (a minimum of two hours out of twenty-four hours). Also try solid foods earlier if sucking still persists to any great degree. More frequent feedings are advisable in many cases and in rare cases even a pacifier might be prescribed.

2. Educate the parents not to attack the problem directly. Scolding, coaxing, shaming, and punishing will do no more good than trying to get rid of the measles by whitewashing the rash. Nagging only causes an increase in tension and unhappiness and increases the habits.

3. Jealousy is a very important factor. It is, therefore, necessary that the parents are advised about this so that they may explain to the child that a new baby is expected. Have them stress to the child how much they are depending on him because he is *older* and can be of such help to them when the new baby does arrive.

4. Twins present a special problem as usually one twin feels inferior to the other and reacts with even greater jealousy than would be felt toward an ordinary brother or sister. Case report on twin will illustrate this problem.

5. Educate the parents and pediatrician that mitts, thumb guards, and elbow splints can cause much mental damage. Practically every medical journal carries ads for these and yet every article written on the subject tells of the harmful effects of using such methods.

SUGGESTED CORRECTIVE METHODS TO USE

1. First determine when the habit is indulged in. Then try to give him the satisfaction he is seeking. Does he have enough food? Does he have enough playthings? Does he have too little or too much company? Are there too many adults conflicting ideas about him? Does he need more loving? Has he been kept from doing things that he is able to do? Is he expected to do things that he is unable to do? Does he feel threatened in his security by a new baby? These questions should help the parents to *why*.

2. When the cause is determined, there should not be any trouble in slowly and gently breaking the habit. If the habit is broken early enough in the course of development, nature itself is likely to repair the damage already done.

3. The orthodontist can show the child the probable results of the habit by showing models and photographs of extreme cases in which habit was the factor in producing such a case. We can be patient, kind, complimentary toward a patient. We can show a genuine and sincere interest in his welfare. We can, by seeing the child at an early age, gain his confidence. We can make the necessary suggestions which the child will pay more attention to than if the same suggestions were made by the parents. We must treat the children as individuals and figure the best method of approach for them. The general instructions that we follow and use with good results are:

General Rules for Breaking Nail Biting Habit

1. Gain the patient's confidence.
2. Photograph (preferably in color) the nails.
3. Give ½ gr. to 1 gr. phenobarbital twice daily depending on age and weight.
4. Have the patient or parent (preferably patient) apply "Reminder" lotion to his nails several times daily and explain that this is just to be a reminder for him.
5. Instruct the patient to scrub hands and nails thoroughly before eating; otherwise the lotion will spoil the taste of any food that comes in contact with it.

6. Give only enough lotion and medication for one week as the patient must be seen at frequent intervals and must be complimented on even the slightest improvement.

7. Several things are accomplished by this. Nails and hands are kept much cleaner and almost automatically the patient will begin to take better care of their whole general appearance. Also, if appliances are being used, there is much less chance of their becoming distorted and out of adjustment.

8. Parents are instructed that any nagging must cease.

General Rules for Breaking Thumb-Sucking Habit

1. First check carefully as to when most of the sucking takes place. We have found that in most cases it is indulged in when the patient is overtired or bored.

2. Paint fingers and thumb with "Reminder" lotion several times daily and especially before retiring.

3. Patients over 5 should have ½ gr. to 1 gr. phenobarbital depending upon age and weight one-half hour before bedtime, preferably with a warm glass of milk or light snack of some kind. For patients under 5 usually ¼ gr. of phenobarbital is sufficient.

4. See patient at one-week intervals and compliment him on even the slightest improvement. Tell him that you knew he could stop the habit.

5. Parents are instructed that any nagging must cease.

6. Give patient one of the little plaster animals as a reward for his being so cooperative. (Even if he is not you will soon obtain cooperation by being kind and interested in him.)

CASE REPORTS

CASE 1.—The patient, P. T., was a 9-year-old girl.

Diagnosis: Class I (open-bite).

Birth: Normal.

Feeding: Bottle fed for fifteen months.

Habits: Thumb, tongue, and mouth breather.

Nasopharyngeal conditions: Tonsils and adenoids removed at the age of 7; no gag reflex.

Psychogenic factors: Obscure, incorrect feeding is a possible factor.

Mental development: Above average.

Vision: Normal.

Hearing: Normal.

Emotional stability: Tendency toward being irritable.

Personal habits: Excellent.

General health: Very good.

Social habits: Slightly on the introvert side.

Heredity: Mother and father of above average intelligence and child had excellent care.

Treatment therapy: The patient was given "Reminder" lotion and ½ gr. phenobarbital; photographs were made of the teeth. The patient returned in three weeks and the thumb habit had entirely stopped. She had also followed corrective swallowing exercises.

Prognosis: Excellent; both parents gave us complete cooperation as far as aiding the child and helping her to remember the correct way to swallow. The thumb habit stopped after the first visit. Further photographs were made at the end of a six-week period and the bite had closed considerably.

CASE 2.—The patient was M.A., a 5-year-old twin girl.

Diagnosis: Class I, Division 1 (open-bite and tongue protrusion).

Birth: Normal.

Feeding: Breast fed for three months. Bottle fed for nine months.

Habits: Thumb-sucking from birth. Tongue perversion from about the age of 4 as open-bite became worse.

Nasopharyngeal conditions: Mouth breather (due to open-bite); hypopharyngeal reflex condition.

Diseases: None to date.

Accidents: None to date.

Tooth structure: Hard.

Psychogenic factors: Patient was a twin, nonidentical and much smaller in stature and bone structure than her twin sister. Difference in size had always been noted. Most people thought she was the younger sister of the larger twin.

Mental development: Average or above, but decided introvert due to sister's domineering attitude.

Vision: Normal.

Hearing: Normal.

Emotional stability: Inclined toward irritability.

Personal habits: Neat and clean.

General health: Very good.

Social habits: Tried to be very friendly but decidedly an introvert, very shy and reticent.

Heredity: Father and mother both college graduates and very even tempered.

Treatment therapy: Placed children in separate kindergartens, watched sister more closely to see that she did not "bully" her and take things away from her as she had done in the past. Complimented her on her hair, which was naturally curly, and other things that were outstanding about her. Made her realize that even though she was smaller in stature that she had many good qualities that her sister did not have.

Treatment therapy used: Jan. 16, 1948: Consultation with mother—impressions. Gave mother "Reminder" lotion to apply to thumbs several times daily and ½ gr. phenobarbital to be given one-half hour before bedtime. Re-

ferred to family dentist to get complete mouth radiographic examination. Examined sister's mouth and found everything normal for her age.

Feb. 11, 1948: Thumb habit and tongue habit had almost completely been corrected. Just sucked thumb very rarely at night. Upon observation of radiographs, everything appeared to be normal. Progress models made as bite had closed considerably.

May 17, 1948: Observation: habit had stopped completely and open-bite was almost corrected.

June 21, 1948: Final impressions: patient was moving out of town and they were advised to check with an orthodontist at once should any change be noted; if not, to have an orthodontist check both children in about a year.

Prognosis: The prognosis was very favorable because the etiological factors had been counteracted. It is very likely that the thumb-sucking and tongue habits which had been broken will remain under control due to the excellent cooperation of both parents. The improved tonicity of the muscles of mastication and expression should materially assist in retention. There was coordination between the teeth, the supporting tissues, the musculature, the functions of mastication, deglutition, respiration, and the psychological complex—each factor acting with the other factors for harmony and the assurance of a favorable prognosis.

CASE 3.—The patient was L. G., a 7-year-old girl.

Diagnosis: Unilateral distoclusion—open-bite.

Birth: Instrument.

Feeding: Bottle fed—three years.

Habits: Thumb-sucking and tongue habit.

Nasopharyngeal conditions: Tonsils and adenoids in but all right.

Diseases: Chicken pox, aged 5, mild.

Psychogenic factors: Obscure, only child, and parents were probably about 40 years of age or over.

Mental development: Normal or better.

Vision: Normal.

Hearing: Normal.

Emotional stability: Very high-strung and irritable.

Personal habits: Neat and clean.

General health: Apparently very good.

Social habits: Introvert.

Heredity: Mother and father, average intelligence. Both had crowded arches and perhaps were superconscious of teeth and trying too hard to do the right things.

Treatment therapy: Advised "Reminder" lotion, ½ gr. phenobarbital. Advised patient that she was really beautiful except for her teeth and those could be just as nice. HABIT STOPPED COMPLETELY IN ONE WEEK.

Prognosis: Very good. Parents were cooperating. No appliance therapy had been used. Hayes Nance theory used for the present. Patient was less irritable and was cooperating in every way. Both thumb and tongue were under control.

CASE 4.—The patient was E. B., an 8-year-old girl.

Diagnosis: Class I (open-bite).

Birth: No record.

Feeding: No record—probably bottle fed—orphan.

Habits: No record up till 7 years of age—patient adopted.

Nasopharyngeal conditions: Tonsils large but all right according to physician's report and should not be removed unless complications arise.

Psychogenic factors: Very obscure—patient was adopted at 6 years of age and no previous reports are available.

Mental development: Average or above.

Vision: Normal.

Hearing: Normal.

Emotional stability: Very friendly, possible factor is lack of personal attention due to former associations.

Personal habits: Clean and neat.

General health: Very good.

Social habits: Obscure but good.

Heredity: Unknown.

Treatment therapy: "To err is human, to forgive is divine." Patient was given "Reminder" lotion and ½ gr. phenobarbital and seen at weekly intervals. No progress at all in this particular case—habit continued. We then tried reverse English. Patient was advised she would no longer be able to visit office until habit was entirely stopped. (This was after a six-month period of getting no place fast. Lotion, sedatives, and rewards had not produced any results.)

Recommendations: Foster mother agreed to our plan of *not seeing patient until habit was under control. Patient was advised that unless habit stopped she could no longer visit office.*

Prognosis: Favorable. February, 1951, the method suggested was tried and in six weeks progress could be seen. This was accomplished by discontinuing "Reminder" lotion and sedatives. It was our opinion that in *this case* only a little special attention was the solution to *this particular habit problem.*

This case, in our opinion, shows that every case is an individual case and every problem should be treated as such.

CASE 5.—The patient was P. B., a 2½-year-old boy.

Diagnosis: Class I (developing open-bite and protrusion—thumb-sucking).

Birth: Cesarean.

Feeding: Bottle fed for twelve months.

Nasopharyngeal conditions: Mouth breather.

Habits: Thumb-sucking and mouth breathing.

Psychogenic factors: Parents had another child when patient was not quite 2 years old. He had a slight thumb-sucking habit which became markedly worse after the birth of the second child.

Mental development: Above average.

Emotional stability: Good.

Social habits: Inclined toward being bashful.

Heredity: Mother and father above average in intelligence.

Treatment therapy: Patient was first seen Nov. 30, 1948. We gave the mother a "Reminder" lotion to paint on his fingers and ¼ gr. phenobarbital to be taken one-half hour before bedtime with warm milk and a light snack. The patient was mentally above average for his age and we gave him some plaster animals to paint and explained about his habit and that a "Young Man" his age should not be sucking his thumb. Patient was again seen Dec. 22, 1948, and the thumb habit had stopped entirely at night. We were better acquainted and were able to take photographs. These showed mouth breathing and a tendency toward protrusion and open-bite. However, these photographs were a definite improvement over his condition on the first visit. Progress photographs and models were made periodically and there was no tendency to return to thumb habit. Latest models showed his bite to be entirely normal.

Prognosis: Favorable. Both parents were cooperative in every way.

CASE 6.—The patient, D. E., was an 8½-year-old girl.

Diagnosis: Class I (open-bite tendency).

Birth: ? Stepchild.

Feeding: ? Stepchild.

Habits: Thumb-sucking.

Nasopharyngeal conditions: Tonsils and adenoids removed at the age of 6.

Psychogenic factors: Patient's mother died when she was very young and her stepmother worked. Lack of attention a possible factor.

Mental development: Average.

Vision: Glasses.

Hearing: Normal.

Emotional stability: Fair, stolid variety.

Personal habits: Just fair.

General health: Fair.

Social habits: Average.

Heredity: Did not find out too much about father except that he was the average labor type. Mother died when the patient was very young. Stepmother was just average in intelligence but did seem to be trying to do the right thing.

Treatment Therapy: July 15, 1950: "Reminder" lotion and ½ gr. phenobarbital.

July 29, 1950: Habit almost under control. All medication stopped.

Prognosis: Fair. There has been definite improvement but it has been slow. Due to stepmother working we have not seen the patient at regular intervals.

CASE 7.—The patient, P. M. P., was a 3-year-old boy.

Diagnosis: Class I (developing protrusion and open-bite).

Birth: Normal.

Feeding: Bottle fed for fifteen months.

Habits: Thumb-sucking.

Nasopharyngeal conditions: Tonsils and adenoids removed at the age of 3.

Psychogenic factors: Parents lived in small apartment. Child was not allowed out to play. When he first came to the office his mother said he would not eat breakfast. Upon further questioning it was found that his mother let him sleep every day until 11:00 A.M. and then gave him a meal of fried greasy foods, which anybody would refuse. The mother said she had even tried to let him cook his own meals in hope that he might like his own cooking better. (This might sound a little farfetched but it is all very true.)

Mental development: Very good.

Emotional stability: Very good.

General health: Fair.

Social habits: Exceptionally friendly and seemed to crave playmates.

Heredity: Parents were below average intelligence.

Treatment therapy: Mother was advised that if the child did not have a place to play or other children to play with he should be put in a nursery school. Also he should be given regular meals and foods that appeal to him. We had some fancy paper plates in the office that were leftovers from a party and we gave those to the patient for his meals.

Prognosis: Eventually it will be favorable because in spite of the mother's lack of intelligence, she was trying to cooperate and do her best. Some progress had been made and more will be made as time progresses. The child actually needed a new mother, but this being impossible we felt that we had done some good; the habit was slowly but surely being controlled and his mouth showed improvement.

CASE 8.—The patient, M. O. H., was an 8-year-old girl.

Diagnosis: Class I (anterior teeth in flaring protrusion and widely spaced).

Birth: Normal.

Feeding: Bottle fed for eighteen months.

Habits: Thumb-sucking nights and when overtired. Mouth breather.

Nasopharyngeal conditions: Tonsils and adenoids removed at the age of 5.

Diseases: None to date.

Psychogenic factors: There was no apparent reason in this particular case. Patient was from a very good family, all well educated, and patient had been very well cared for.

Mental development: Above average.

Vision: Normal.

Hearing: Normal.

Emotional stability: Good, slightly on the introvert side.

Personal habits: Very good.

General health: Very good.

Social habits: Normal.

Heredity: Mother and father well educated, patient, showed much affection for child.

Treatment therapy: July 18, 1949: The patient was given "Reminder" lotion and ½ gr. phenobarbital to be taken one-half hour before bedtime with a light snack. She was advised that we all have habits but to pick one that would not hurt her teeth.

July 27, 1951: Habit had stopped completely. Anterior teeth were much improved. The patient was seen at two-week intervals and teeth continued to improve. Spaces did not close completely so an appliance was used for three months.

March 12, 1951: The patient's habit had not recurred; teeth were holding well.

Prognosis: Very good. Patient and parents were very cooperative. Patient was very much pleased with her mouth.

CASE 9.—The patient was J. F., a 7½-year-old boy.

Diagnosis: Class II, Division 1 (extreme open-bite).

Birth: Normal.

Feeding: Bottle fed for eight months.

Habits: Thumb-sucking, nail biting, mouth breather, and tongue perversion.

Nasopharyngeal conditions: Tonsils and adenoids removed, aged 7.

Diseases: Chicken pox, aged 7, mild; whooping cough, aged 6, average.

Psychogenic factors: There was really no apparent reason in this case. Patient was easy going and was apparently not disturbed by anybody or anything. He had no apparent tendencies toward jealousy of his younger brother. He has had excellent care. Nail biting takes place while studying, thumb-sucking is usually just at night, and tongue is at work between times.

Mental development: Far above average and decided extrovert.

Vision: Normal.

Hearing: Normal.

Emotional stability: Very good in spite of habits.

Personal habits: Fair, best described that he was a typical boy and had the usual allergies toward soap, water, and a toothbrush.

General health: Very good.

Social habits: Extreme extrovert.

Heredity: Both parents were very intelligent and well educated but perhaps too easy going.

Treatment therapy: March 15, 1950: "Reminder" lotion and ½ gr. phenobarbital was given to patient.

March 17, 1950: Patient's mother called and said thumb-sucking had stopped immediately and neither lotion nor pills were needed.

March 30, 1950: Models and photographs made.

April 12, 1950: Nail biting fairly well stopped and tongue perversion was much better.

May 12, 1950: Appliances placed.

Sept. 7, 1950: Progress photographs made. Open-bite was closing and patient was trying in his own way to correct swallowing habit and keep tongue in place.

Prognosis: Very good for thumb and nails. Open-bite had improved considerably but he did need more supervision at home. Parents had been advised that he should be reminded in a nice way, without nagging, about his tongue habit. Control will not be complete until we get the parents' cooperation. However, definite improvement had taken place.

CASE 10.—The patient was C.P., a 6-year-old boy.

Diagnosis: Class II, Division 1 (extremely high vault and narrow arch).

Birth: Breech.

Feeding: Bottle fed for nine months.

Habits: Thumb-sucking till the age of 14 months—mouth breather.

Nasopharyngeal conditions: Tonsils and adenoids removed—aged 21 months; removed again—aged 6 (no gag reflex).

Diseases: Chicken pox, aged 10 months, severe.

Allergies: Feathers, furs, and some foods.

Mental development: Normal but appeared otherwise due to speech defect.

Vision: Normal.

Hearing: Normal.

Emotional stability: Very nervous and high-strung.

Personal habits: Neat and clean, perhaps a little on the fussy side.

General health: Average—subject to colds.

Psychogenic factors: Parents well educated but father and mother a little too conscious about allergies. (Freud stated, "Early impressions are imperishable.")

Heredity: Father, father's sister, and father's mother all had irregular teeth, small arches, and high vaults and were all mouth breathers.

Social habits: Introvert.

Treatment therapy: Oct 3, 1950: The patient was put on Life Saver exercise. Photograph and cephalometric x-rays were made.

Nov. 2, 1950: Progress cephalometric x-rays and photographs were taken. The patient showed improvement and he was doing his best to cooperate.

March 16, 1951: The patient had been seen at two-week intervals. Mouth showed definite improvement. Speech was improving and nervousness and twitching were less noticeable.

Prognosis: Should be very good. Upper arch was gradually developing and patient was doing his best to cooperate.

CASE 11.—The patient was S. E., a 9-year-old boy.

Diagnosis: Class II, Division 1 (extreme open-bite).

Birth: Normal.

Feeding: Breast fed for seven months—bottle fed for ten months.

Habits: Thumb-sucking which was stopped with guards (prescribed by family physician); then patient changed to sucking forefinger of right and left hand mostly at night and when tired. His bite also caused bad tongue perversion and incorrect swallowing habits.

Diseases: Measles—aged 6, average; mumps—aged 7, mild.

Nasopharyngeal conditions: Mouth breather, infected tonsils which were removed two weeks after first visit to the office.

Psychogenic factors: Patient's mother started to work when he was 7 months old at which time he was changed to bottle feeding. He was allowed to have the bottle for ten more months. When taken off the bottle he switched to thumb-sucking. His mother became disturbed about this and used guards which stopped thumb-sucking but he then switched to the forefinger on the right and left hands.

Mental development: Normal, but extreme introvert.

Vision: Normal.

Hearing: Normal.

Speech: Lisp.

Emotional stability: Highly nervous.

Personal habits: Average.

General health: Fair.

Social habits: Extreme introvert, only child and not willing to mix with others.

Heredity: Mother seemed of average intelligence and she was most anxious to cooperate. Have never seen or heard about child's father.

Treatment therapy: Oct. 24, 1949: "Reminder" lotion and ½ gr. phenobarbital were prescribed and much attention was shown to the patient.

Oct. 27, 1949: Lotion and phenobarbital were discontinued. The patient had completely stopped finger-sucking. The patient's tonsils were removed and he was put on corrective swallowing exercises. After a six-week period and a decided improvement in his open-bite, regular orthodontic procedure was started.

Prognosis: Very favorable. Patient and mother were very cooperative. At the time of writing the patient was on a rest period, but we saw him more frequently than would ordinarily be necessary because attention he received in the office had changed his whole personality.

268 MOORE ST.

FUNCTIONAL MALOCCLUSION IN ORTHODONTICS

BLAIR C. MADSEN, D.D.S., MIAMI, FLA.

YOU who are engaged in the practice of orthodontics have earned and enjoyed an enviable position in the eyes of the entire dental profession. Patients are referred to you with a sincere feeling of security and confidence because everyone feels that you know all there is to know about orthodontics and occlusion.

In my small way as a periodontist I hope to be able to contribute something today to help you maintain that confidence which has been placed in you.

Forty-eight years ago a prominent man in dentistry made a very important statement. His statement consisted of just three words; those words were: "Dentistry is occlusion." In spite of the great progress made in the science of orthodontics in these last fifty years, we are just beginning to realize the full value of that man's statement.

The orthodontist of today is not solely interested in the satisfaction of the esthetic and cosmetic factors. Stress is being made upon the functional concept of occlusion to preserve masticatory efficiency and periodontal integrity as well as arch form and the cosmetic factor.

It is estimated that 65 per cent of all people over 35 who lose their teeth lose them because of periodontoclasia. Functional malocclusion is the chief cause of periodontoclasia, temporomandibular dysfunction, and destruction of arch form.

Many seemingly excellent completed orthodontic cases are predestined to failure because we fail to detect interferences existing on certain teeth, which alter the definite and powerful hinge axis closure of the mandible. In the normal function of closure there must be a positive correlation between two factors: namely, *centric relation* and *centric occlusion*. (Centric relation is defined as the relationship that exists between the condyle and the fossa when the mandible is in rest position. Centric occlusion is the relationship that exists between the cusps and fossae of the teeth when the teeth are closed.)

Approximately 45 per cent of your patients will reveal a conflict between these two factors, if a proper diagnosis is made. This conflict which occurs during the hinge axis closure is *Functional malocclusion, the greatest destructive force in the human mouth today!*

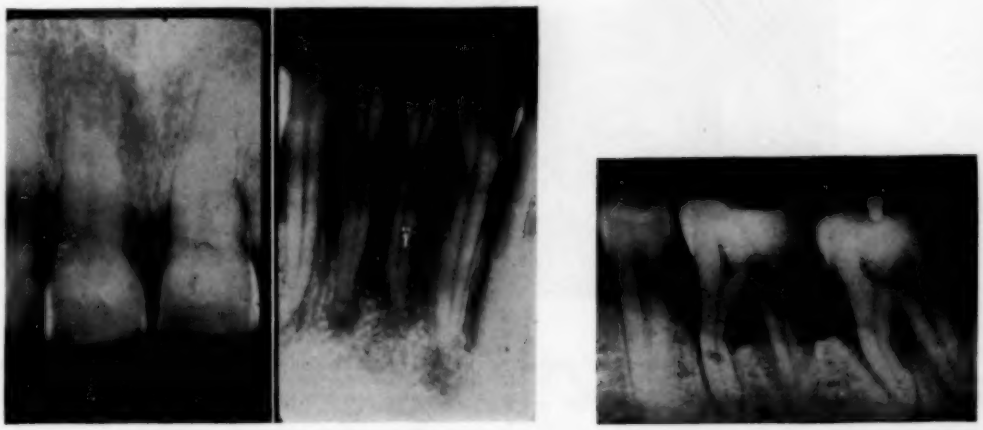
There are four reasons why you should be interested in the study and application of the science of equilibration of occlusion: (1) Because it is so basic and fundamental; (2) because it will be of great help in eliminating any forces which may be working against you during the course of your treatment; (3) because it will help you prevent collapse or failure in your completed cases; (4) because it will assure you of the preservation of masticatory efficiency and peridontal integrity.

Presented before the American Association of Orthodontists, Louisville, Ky., April 24, 1951.

Fig. 1 shows the mouth of a young man 21 years of age whose orthodontic work had been completed three years previous to his visit to my office. He had been quite concerned about a recurrent inflammatory area near the upper left central incisor. He complained of a general sensitivity to pressure during mastication. A lack of normal gingival tonicity was apparent throughout the mouth.

A radiographic examination was made and three roentgenograms are shown (Fig. 2) to illustrate the advanced stage of periodontoclasia due to traumatic factors.

Fig. 1.—Orthodontic patient in eccentric *occlusion*.



A. *B.* *C.*

Fig. 2.—*A*, Upper anterior teeth; *B*, lower anterior teeth; *C*, lower right posterior teeth. Note bone loss.

In the practice of periodontia we are encountering an ever-increasing number of young people in varying stages of periodontoclasia. When a diagnosis of periodontoclasia due to a functional malocclusion is given, the former orthodontic patient invariably asks, "Could the straightening of my teeth have had

anything to do with my present condition?'' A direct answer to this question is avoided by saying that the most common cause of functional malocclusion is a premature contact in the hinge axis closure of the mandible.

THE DIAGNOSIS OF FUNCTIONAL MALOCCLUSION

The diagnosis of functional malocclusion (or presence of a premature contact in the hinge axis closure of the mandible) is illustrated in Fig. 3. This picture was obtained by asking the patient to concentrate on four things: (1) to

Fig. 3.

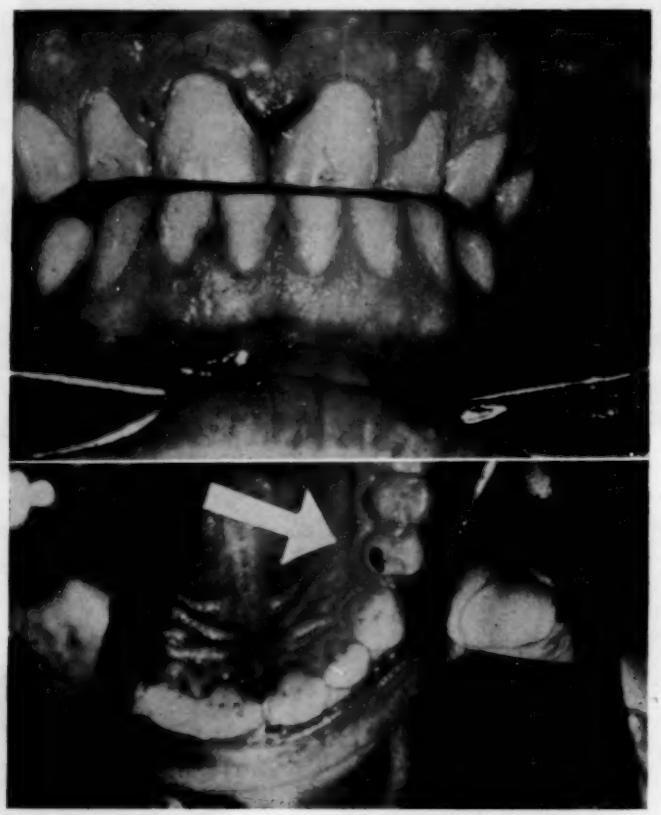


Fig. 4.

Fig. 3.—True centric *relation*—closure in hinge axis—patient resting "in contact" on premature contact on left side.

Fig. 4.—Carbon paper recording of premature contact.

completely relax with the jaws almost closed and to remain in rest position; (2) to keep the lower teeth from touching the upper teeth until a signal is given to do so; (3) to close the jaws lightly (without musculature exertion) until the first tooth is felt in contact; (4) to point to the area where first contact is felt (first contact was felt in the left premolar area). (The mandible may be *gently* guided into retrusion by finger pressure exerted on the labial surface of the lower central incisors—it is not necessary to use force.)

The first contact felt in this mouth is indicated by the carbon mark in the left premolar area (Fig. 4). This is the primary premature contact, the first interference to the arc of the powerful hinge axis closure of the mandible. The normal arc of closure of the mandible is altered by this interfering area, and to achieve full closure the mandible is thrust from this area into an eccentric occlusion as shown in Fig. 1.

Fig. 5.

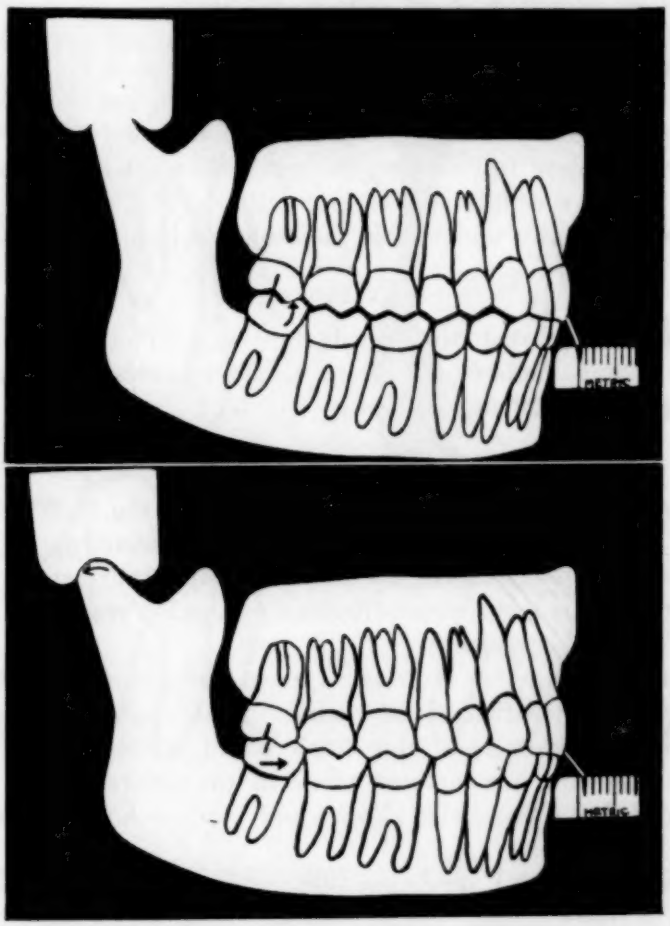


Fig. 6.

Fig. 5.—Working model showing location of a premature contact on second molar. Contact is felt in hinge axis closure; bite still open, condyle in fossa. This is the first contact (premature) in hinge axis closure.

Fig. 6.—Working model. Protrusive slip from premature contact. Mandible now thrust in eccentric closure.

Since it is so difficult to demonstrate the mechanics of this lack of correlation between centric relation and centric occlusion on study models or in the mouth, I have devised a working model which serves to illustrate the mechanical principles involved (Fig. 5).

The model is composed of Plexiglas. The maxillary and temporal portions are bolted to the black base. The mandibular portion has freedom of movement

and is held in contact with the temporal portion by means of vertical rubber bands which exert sufficient pressure to keep the condyle in the fossa. The outlines of the teeth have been routed in and painted black. The upper second molar is removable, and plastic teeth with varying cusp inclines can be inserted in the opening. The upper central and lateral incisors are also removable but are held in place by a bolt through the back which allows them to be forced forward; spring tension is designed to hold them posteriorly. The amount of forward movement can be measured on the scale by the displacement of the needle, which is attached to the upper central incisor.

The premature contact on the model is in evidence in the second molar area (see arrow, Fig. 5). Contact is felt by the patient, yet the bite is still open. (Note position of needle on scale and position of the condyle in the fossa.)

In order to achieve full closure, the mandible must slide protrusively from this point of interference into an eccentric position (Fig. 6). When this slippage or propulsion occurs two undesirable factors come into play simultaneously.

FACTOR I

The mandible is thrust protrusively by this interfering inclined plane and sufficient horizontal displacement occurs to move the upper incisors anteriorly 1 mm., as the model attains full closure (Fig. 6).

FACTOR II

The condyle is thrust into the posterior part of the fossa (as indicated by the arrow in Fig. 6), allowing it to produce undue pressure upon vital structures such as the petrotympanic fissure, the anterior tympanic artery, and the auriculotemporal nerve. This temporomandibular dysfunction results in a multitude of acute and chronic symptoms.

During normal function there is a typical hinge movement of the mandible as it closes from rest position to full closure. There should be no protrusive propulsion of the mandible or posterior displacement of the condyle, yet the model clearly illustrates how one inclined plane in premature contact can alter the powerful and definite hinge axis closure and produce both of these undesirable factors.

In discussing Factor I, we do not fully realize the importance of the correlation of centric relation and centric occlusion until we consider the law of the inclined plane and its displacement potential. Dr. G. V. Black, in his tests on 1,000 patients with the use of the gynathodynamometer, discovered that the average patient could exert 171 pounds of pressure in the molar area. In examining the interfering inclined planes that are in premature contact on the model (see arrow, Fig. 5) we find that they are approximately at a 45° angle. Therefore, according to the laws of physics pertaining to the inclined plane and by the use of simple trigonometry, we find that this "average" pressure of 171 pounds, applied and functioning along a 45° interfering inclined plane, will produce a secondary horizontal displacement force (anteriorly) of 171 pounds. (Proof of this statement lies in the fact that the vertical and horizontal component parts of a 45° triangle are equal.) Interfering inclined planes of greater degree

result in greater pressures of horizontal displacement, reaching as high as 350 pounds for a 67½° angle. It is this constant tremendous mesiodistal stress (applied to all teeth) that causes temporomandibular dysfunction, destroys the supporting structures, and ruins arch form in completed orthodontic cases.

THE CORRECTION OF FUNCTIONAL MALOCCLUSION

Premature contacts which interfere with the normal hinge axis closure of the mandible almost invariably occur (and show carbon marks) on a *distal inclined plane* of the lower tooth involved and a *mesial inclined plane* of the upper tooth involved. The correction or elimination of these interferences is

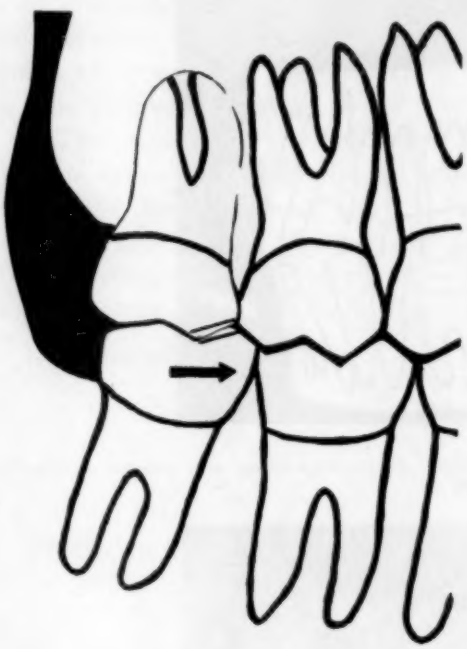


Fig. 7.

Fig. 8.

Fig. 7.—Method of correction of functional malocclusion (reduction or elimination of premature contacts).

Fig. 8.—*Prematurity* corrected. Molars now occlude in accordance with normal arc of hinge axis closure in accordance with the dictates of temporomandibular articulation.

accomplished by means of reduction with a stone, along the lines indicated on both cusps involved (Fig. 7). The reduction is made first on the lower tooth, grinding from the height of the carbon mark (near the tip of the cusp) toward the base of the fossa. The reduction is then made on the upper tooth, grinding from the height of the carbon mark (near the tip of the cusp) toward the base of the fossa. The objective is to make these interfering distal and mesial inclined planes, which strike first in the hinge axis closure, approach horizontal planes. When this reduction is accomplished (Fig. 8) the inclined planes of these cusps will no longer interfere with the arc of closure (or the normal hinge axis closure) of the mandible, as dictated by the temporomandibular articulation.

This precise and discriminate reduction of interferences will not "close the bite" or affect the vertical dimension because no grinding is done at the tip of the cusp or at the base of the fossa. The grinding is done only along the interfering incline of the cusp.

The working model (Fig. 9) can now be closed from rest position to full closure without protrusive slip, without mesiodistal stress on all teeth, without displacement of the upper anterior teeth, and without forcing the condyle into the posterior part of the glenoid fossa. *Centric relation* and *centric occlusion* have now been correlated.

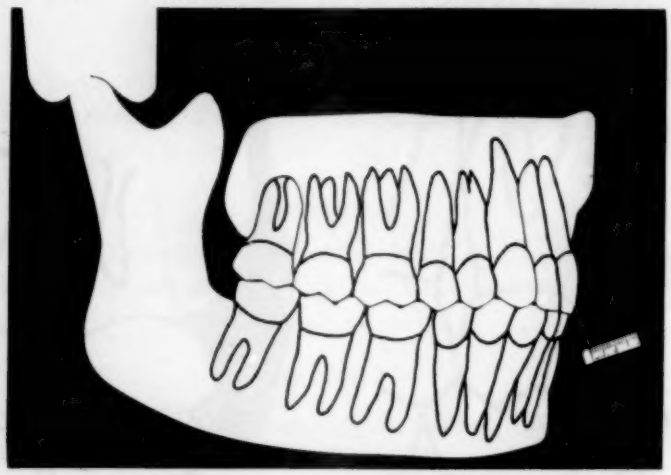


Fig. 9.—Working model in normal or proper function. Centric relation and centric occlusion correlated.

Fig. 10.—Evidence of early bone regeneration. X-rays taken one year apart.

Under actual working conditions in the mouth, we find that the protrusive slip will not be eliminated after reduction of the first interfering areas. In such cases, simply repeat the original process. With the mandible in rest position have the patient close, determine the new location where first contact is felt, obtain the premature marking, and again reduce the interfering inclined planes on the two teeth involved. This is to be continued until all teeth meet simultaneously, and all slippage is eliminated.

Evidence of the beneficial results obtained by occlusal equilibration can be seen in the two radiographs which were taken one year apart (Fig. 10). This serves to illustrate that impaired teeth, with symptoms of tenderness, suppuration, and evident bone loss can be improved. These impaired teeth can be made comfortable, tissue tone can be restored, and early regeneration of the bony matrix can be demonstrated.

Interferences in lateral and protrusive excursions of the mandible have their destructive effect upon the supporting structures and arch form, but time does not permit going into a discussion of these factors.

CONCLUSION

The orthodontist of today should routinely make a survey of the "*function*" of occlusion, at least upon completion of every case. If functional interferences are present he should correct them or have them corrected to be sure of a good prognosis in every case.

The science of orthodontics can be further refined and its position enhanced (in the eyes of the entire dental profession) by the timely recognition and correction of this condition.

For fifty years the American Association of Orthodontists has made continuous progress in the science of orthodontics—let us be aware of this cardinal consideration and *continue to progress!*

735 DUPONT BLDG.

THE DEVELOPMENT OF THE EDGEWISE ARCH MECHANISM AND ITS PLACE IN CONTEMPORARY ORTHODONTICS

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A STUDY of the background of orthodontic appliances reveals that the trend during the latter part of the nineteenth century consisted largely of a search for an efficient means of attachment to teeth; the multiplicity of appliances of that day afforded, to varying and limited degrees, the means for aligning crowns, chiefly by tipping movements. Moving teeth bodily was shown to be desirable by the more difficult cases of malocclusion, but the ingenuity manifest in the earliest attempts in this direction was often exceeded by inherent impracticality. Without attempting to say definitely who first developed a method for the bodily movement of teeth, it may be safely said that in the pin and tube appliance of Dr. Edward H. Angle, reasonable simplicity met adequate control for the first time. This appliance was so efficient in its operation and so simple in its design that it won immediate favor. As originally advocated, the pin and tube appliance consisted of a labial arch wire carrying round pins which were to be inserted incisogingivally into round tubes soldered parallel to the long axis of each incisor band. When the arch wire was adjusted so that it pressed gingivally in the tube, gentle movements of depression would occur; suitably locked in its tube, the pin could produce gradual vertical development, or extrusion. When the arch wire was adjusted so that the pins were labial to the tube, labial movement was elicited when the pins were seated, and in similar fashion lingual movement could be brought about.

Mesial or distal movement of individual teeth was accomplished by shifting the pin upon the wire, and teeth could be rotated by establishing a traction point at the tube, and a pressure point remote from the tube, with arch wire bearing upon the labial of the banded teeth. Here was control over individual teeth in three planes of space; furthermore, the type of movement known as "jiggling" was eliminated, for the teeth could move only in the one desired direction. The control over the teeth afforded by this appliance whose bulk was brought almost to the irreducible minimum was then enhanced by the substitution (not by Dr. Angle, but by others) of half-round tubes and shafts for the round attachments first advocated. It would seem at this point that appliance design had been brought to a degree where the operator could accomplish any sort of tooth movement which he could visualize, and capably express in arch wire manipulation; whatever else might be said of the appliance in this form, it certainly was not lacking in control. It should be kept in mind that the tube, whether round or half-round, was soldered to the band in the full extent of its length; there was no opportunity, through distortion or springing, for freedom of the pin within the tube to increase. Soon after the introduction of the pin

Presented at the fiftieth anniversary meeting of the American Association of Orthodontists at Louisville, Ky., on April 25, 1951.

and tube appliance, it became evident that the precision required in locating the pins on the arch wire taxed the patience of all who used the appliance, and the technical ability of many.

The next development in appliance construction to come from Dr. Angle was the ribbon arch, which, like the pin and tube, made possible the control of individual teeth in three planes of space. Now, however, it was no longer necessary to determine with meticulous exactness the position of every banded tooth upon the arch wire, for the innovation of the bracket permitted the banded teeth to move along the arch wire at the will of the operator. This technical feature was due to the fact that the tube principle was abandoned for the bracket principle; in effect, the mesial and distal walls of the tube were removed. This modification of the attachment reduced its rigidity; the bracket was attached only at the gingival extremity, and force applied at the incisal could permanently deform the bracket, enlarging the space for the arch wire. Indeed, this enlargement of the slot could occur even before an arch wire had been inserted in the bracket.

Those familiar with the ribbon arch band will recall that only the labial wall of the slot is supplied by the bracket, and that the band itself, reinforced by a thickening of the band material, supplied the lingual aspect of the slot. In stretching and burnishing a ribbon arch band to fit a tooth with pronounced labial convexity, e.g., a maxillary cuspid, one actually increases the size of the slot at the incisal aspect by pulling the band away from the bracket; repeated insertion of arch wires increases this freedom until the walls are no longer parallel and the slot becomes mildly funnel-shaped. That this occurs in use may be verified by the examination of bracket bands which have been removed after completion of treatment. These used attachments will fit the standard arch wire closely only at the base of the slot, where the bracket has its attachment to the band. At the incisal extremity, particularly where torquing adjustments have been a part of treatment, there is enough play that it is often possible to rotate the arch wire almost through 90°. Instead of the original slot dimension of 0.022 inch, the used bracket approaches a width of 0.036 inch at its incisal extremity, and the accurate fit which might be supposed to exist does not. Obviously where such a situation exists, it becomes evident that for torquing requirements slight bends in the arch wire cannot take effect in the loose bracket; only when these bends are exaggerated will it be possible to accomplish precision tooth alignment by exerting pressure upon the diverging walls.

This tendency for the slots in the brackets to enlarge through use was ignored by most operators intent upon using an appliance which fulfilled the requirements of bodily tooth movement more conveniently than any offered before. One orthodontist, however, recognized the weakness of the stamped bracket as originally designed, and sought to secure the close fit that he thought desirable by using a milled bracket. He had a machinist make a number of these brackets, all milled with an accurately fitting slot of 0.022 inch by 0.036 inch, and put them into use on his patients. It soon became evident that this play previously provided through distortion was not a disadvantage, but actually beneficial.

So closely did these experimentally produced brackets fit the arch wire, that the latter could not be seated without difficulty unless its relationship to the bracket was altogether passive, and even then, mild pressure was required; when the arch wires were worn a short period of time, the patients experienced extreme soreness and the teeth were definitely loose. The experience with the milled brackets was so disappointing, and the consequences so undesirable, that they were summarily removed and replaced with the conventional attachments.

After observing the results of treatment with the ribbon arch over a number of years, Dr. Angle sought to improve appliance mechanics still further by increasing the number of teeth under precise control by creating the edgewise wing bracket, originally to be used in conjunction with the ribbon arch appliance. He soon became aware of the mechanical possibilities of these brackets, and he discarded the ribbon arch principle and inaugurated the use of this bracket for the entire assemblage. "The latest and the best," as Dr. Angle called the edgewise arch, provided a bracket slot which was entered from the buccal surface instead of the incisal, and made possible the control by brackets of all teeth which could be banded.

The first edgewise bracket, the 447, was a stamped bracket, and, like its predecessor the ribbon arch bracket, was susceptible to distortion through both arch wire use and the forces of mastication. It was believed by some that the wings of the 447 bracket could be drawn into viselike contact with the arch wire by snugly tied ligatures, but this opinion was far from unanimous. In using either stamped bracket, ribbon arch, or the 447, edgewise bracket, it was necessary to incorporate exaggerated bends in the arch wire in order to engage the walls of the bracket slot which had become divergent. Undoubtedly, the original bracket, by virtue of its softness, was capable of distributing forces to the teeth in a much more gentle manner. Perhaps the general objection to this bracket resulted from the same misuse that was experienced by me. I was not sufficiently impressed with the proper seating of the arch wires and depended upon the ligature tiers for this purpose. When forces were not effective, the arch wire bends were exaggerated to such an extent that the ligature ties would not draw them into place properly, resulting in bracket distortion without effective tooth movement. When this discovery was made and the bends reduced to the form recommended by the creator of this appliance, and seated gently with the torquing keys according to original instructions, the desired results were obtained. Another bracket, the 448, especially designed for close-bite cases and for patients with long cusps, was more bulky and accordingly more resistant to distortion, but an inconvenient ligature tie prevented its general acceptance by those using the edgewise arch.

Because the placing of compensating bends in the arch wire to gain influence over the bracket constituted a break with the most exact concept of the ideal arch philosophy, orthodontists sought a bracket which would not yield to distorting forces arising during treatment. The result of this demand was 457, or "hard," bracket,[1] which was milled rather than stamped. When the full complement of teeth was banded with this bracket, every tooth responded to the slightest alterations in the arch wire, and no compensating bends were required to elicit the type of movement contemplated.

It is curious to note that it was not long until orthodontists began to move unconsciously away from the desired "severe fit" so ardently sought when the soft, or 447, bracket was the only one available. They began to seek freedom of the arch wire within the bracket by the use of arches smaller than 0.022 inch by 0.028 inch the original working dimensions of the edgewise arch. Light, round steel arch wires of 0.016 inch, 0.018 inch, and 0.020 inch came into wise use for the initial stages of orthodontic treatment, and often lingered over into later stages in the hands of some operators. Many orthodontists who limited their use of round wire to the earliest stages of treatment came to use 0.021 inch by 0.025 inch, and 0.0215 by 0.028 inch, in arch wires for the major portion of treatment in order to reduce tissue shock. Some orthodontists are routinely using 0.020 inch by 0.028 inch arch wires in the standard 0.022 inch by 0.028 inch slot. Oddly enough, it is seldom necessary at the end of treatment to use new ideal arch wires of 0.0215 inch by 0.028 inch, or 0.022 inch by 0.028 inch. Most orthodontists who use the hard or substantial bracket have learned to express their concept of tissue tolerance by a reduction in the size of the arch wire, and feel that their operating knowledge is more accurate with a known variable.

To return to the first two appliances mentioned, the pin and tube, and the ribbon arch, Dr. Angle realized that the most orderly and most efficient method of correcting malocclusions was to arrange appliance placement so that at the completion of treatment the arch wires, as well as the teeth, would represent the ideal arch form. He emphatically taught the accurate relative placement of bracket carrying bands on each of the teeth. He expressed his opinion of the requirements of treatment by first creating an arch wire that corresponded to the malocclusion, one which fit the tubes or brackets passively, and then, by a series of delicate adjustments, removed the irregularities, and at the same time the arch wires assumed an ideal form there was complete correction of the diversities which had existed when the teeth were in malocclusion. With these precision appliances, treatment could not be successful unless in each step the technical requirements were carried out in a highly skillful manner and in the proper sequence also; otherwise it would be difficult and sometimes impossible to regain what had been lost by overlooking earlier requirements.

Within the edgewise appliance were incorporated all of the mechanical advantages of the three previous appliances, the E arch, pin and tube, and ribbon arch, plus the ability to make use of bracket bands on all of the teeth for increased stability and anchorage control, as well as to make possible the en masse movement of the teeth of the dental arches, either in a mesial or distal direction.

An orthodontic bracket appliance which would possess the maximum control in the distribution of force in all required directions would resemble one with a square or rectangular opening which would accurately cover a square or rectangular arch wire on all sides, such as the rectangular tube used on molars. Within the edgewise bracket, the arch wire is enclosed by three walls, the fourth, or labial, wall being left open so that the bracket may be gradually drawn to the wire, and finally, completely seated. It represents the maximum control on the three sides, and when closed on the fourth side by the ligature

tie, it answers all requirements except that of rotation, which is inadequate because the bracket is too narrow to permit the arch wire to spring sufficiently to allow it to be held firmly against its base, and a special staple tie was necessary. This lack of rotating convenience has, however, been completely overcome by the ribbonlike strip of metal which has been described by Dr. Paul Lewis.[2] Rotations are generally accomplished by the conventional ligature tie when these rotating wings are carefully placed, and by activating them it is simple to accomplish the over-rotation which is so often desirable before removing appliances. Another, and even greater, advantage in its use is the important reduction of pain to the patient.

In treating malocclusions, we have no standard rules or laws which dictate a measurement of forces which will remain within physiological limits during the accomplishment of the many directional adjustments that are necessary. Within the pin and tube, and ribbon arch techniques, the experienced operator has developed judgment as to the amount of action that can be placed by the extent of the adjustments of the arch wire which would remain within range of tissue tolerance, and not cause excessive pain. He has developed, also, knowledge of the duration of this force, and could predict the proper time for additional adjustments. With the edgewise mechanics, or ideal arch treatment, the ligature tying pliers are considered a great burden by many; however, these pliers are the medium through which the operator is permitted to express his concept of tissue tolerance by exerting tension that will cause the minimum tissue destruction. Within this thought lies the compensation for the individuality of both the operator and the tissue reactions of the individual patient; therefore, the ligature tiers become a most important adjunct to the successful use of the edgewise appliance. With properly placed bracket bands and accessories, the time consumed in the use of this instrument is not excessive, for with skillful execution of a proper plan it is not necessary to remove and replace full arch wires at short intervals. There can and must be established at the beginning a complete plan for the correction of each malocclusion, and with the accurate control which lies within this appliance, this plan can be carried through with complete freedom and rhythm.

So much has been published relative to the correct use of the edgewise appliance since it was introduced by Dr. Angle in 1928 that it is impossible to offer anything new, through observation of its use by various orthodontists during these years, however, there is evidence that a few important technical requirements are often overlooked. The predetermined ideal arch technique has received a great deal of attention. At the present time, while basic technique remains the same, minor modifications have been accepted, such as a reduction in the extent of the offset bends for the lateral incisors, and the curve for the upper canines—a mild buccal bend for the first premolars, and bayonet bends for the molar teeth which have been incorporated. For several years it has been emphatic practice of those using the edgewise appliance to modify ideal arches so that they conform to the individual arch pattern. A tracing of this modification is made, and this is used for future reference.

At the time the edgewise appliance was introduced, the basic plan for the correction of malocclusions was to treat to dental pattern by constructing an

arch wire of sufficient length or breadth to accept the teeth when their contacts were normal, and the belief was, as we all well know, that distribution of mechanical forces through the roots of the teeth would encourage the formation of supporting bone. For this plan of treatment the appliaince was adequate, having distinct control in the movement of teeth in all directions. With the ensuing ten years, the number of relapses after retention encouraged individuals to reappraise their clinical work, however, with more discouraging results. Perhaps the most complete and important of these clinical investigations was that of Dr. Charles Tweed, who, not long after the beginning of his survey was forced to question the formation of this supporting bone which was supposed to have been developed. He decided that if it formed at all, the amount was not sufficient to support the teeth adequately in their new positions and maintain them in good health. The relapse percentage was extremely high for malocclusions of the Class I type, as well as other types which were complicated with severely crowded lower anterior teeth, and in their readjustment after retention they seemed to approach the original arch pattern. He then recommended in malocclusions of this type that until something better could be offered, and for the sake of future dental health, that we turn back the pages of history, and that sufficient dental units be removed to allow those remaining to occupy positions upon what he called basal bone. Opposed to the general feeling, Dr. Tweed's interest and actions were dictated by the discouraging tissue reactions during and after treatment, and with the relapse chiefly in the lower anterior region. The esthetic improvement of which he has written was a matter of secondary inspiration. Since 1936, this plan of treatment has been accepted to varying degrees by a great number of orthodontists, and may have contributed to the refinements in the application of mechanics, so that at the present time, provided the plan of treatment is justified, the result will be obtained without burden to either the patient or the operator.

The treatment plan as far as mechanics are concerned, when spaces are to be closed, demands an appliance which is capable of absolute control of the mesial, or distal as well as the buccal-lingual axes of the teeth, and the three walls of the edgewise bracket offer this mechanical control. Because of the dimensions of the arch wire, there is sufficient strength to offer adequate resistance to distortion at the area of the space when a continuous arch wire is used, and it possesses sufficient force when used as loops for the purpose of closing the space and paralleling roots should the operator choose to follow that plan of treatment.

Band forming technique, as originally offered by Dr. Angle, and published in Dr. Strang's *A Textbook on Orthodontia,*[3] is certainly an efficient and rapid method of accurately fitting bands when the step-by-step outline is followed precisely, one which, after a little practice, enables the operator to adapt bands rapidly with a minimum of tissue discomfort to the patient. Because of my interest in the latter, I have sought to reduce this tissue discomfort as far as possible by pre-forming the bands which were most difficult to adapt in the mouth, mainly the maxillary cuspids. The success of this attempt has led me to include the preformation of bands in a similar manner for many of the other teeth. The method used for this is to begin with metal teeth of an average

size, and exaggerate their basic contour, using the same band forming pliers and technique as previously mentioned, so that after pre-formation of a band on one of these teeth, when placed on the tooth in the mouth, the incisal and gingival margins only would be in contact. The snug contact permits the band to slide under the free gingivae, causing practically no discomfort. With a simple drawing up of the band forming pliers, it has been much easier to reduce the over-contour than it was originally to stretch the band material in the center, and burnish the incisal edge to conform to the tooth contour. Burnishing, I am certain, is not effective unless considerable pressure is used; otherwise, the metal will not flow but it will wrinkle. This method of band formation enables an operator to use band materials which possess the highest edge strength. The unfortunate situation of having bands become loose or being opened at the margin by a staple tie, with resultant etchings or more serious enamel destructions, has been completely relieved by using the more rigid metals and increasing the thickness to a point where it is adequate to withstand the chewing forces which we, regardless of our instructions to the patient, will be unable to control.

The proper vertical location of the band has been described as that occupying the middle third of the crown of the tooth, with the central incisors being used as a guide for the balance. As a general rule this location will give a satisfactory mechanical relationship; however, due to the variance in pattern of the crowns of the teeth, it becomes necessary to vary this location either slightly toward the gingival or incisal area. Instead of beginning with the central incisors, it is much more desirable to fit and adjust the upper cuspid bands first, and use their location as a guide for placement of the bands of the balance of the teeth, with the exception of the lateral incisors, for which the proper position would be mildly toward the incisal area. Although this location may place the cuspids gingivally a small amount more than normal at the end of treatment, it is felt that it is a more desirable position in which to leave them. If the brackets have not been placed correctly, and as treatment approaches the end, the operator may hesitate to remove bands in order to reset them to their proper height. To quote Steiner,[1] "He would do the usual thing, guess at the error and compensate for it by making a bend in the arch bar which would, of necessity, be another guess." When this is done, the entire rhythm and basic value of the edgewise technique is completely destroyed, for the ideal arch is the means by which the result is obtained, and for refinement, at the end of treatment, it should not be used as a ribbon arch.

For the purpose of accurately locating the bands and bracket attachment on the teeth, the points of a small pair of dividers have been modified so that one point is made 3 mm. shorter, and this shorter leg has been ground to fit the 0.022 inch dimension of the edgewise bracket. The longer leg is designed to rest on the incisal edge of the anterior teeth, and on the crest of the cusp of the posterior teeth. With the bracket fit of the short leg, it is a simple matter to locate the bracket so that its opening is the same distance from the incisal edge when the dividers leave the tooth surface at right angles. Unless the bracket location is measured in this manner the distance from the incisal edge may not be accurate. It may be well to call your attention to the beautiful vertical tooth

alignment which appears in all of the diagrams describing treatment techniques. This desirable cusp alignment is produced by a careful drawing of the bracket placement. When this alignment does not occur in the mouth, it is simple proof that technical requirements have been neglected at the beginning of treatment. One of the most common errors in vertical height placement of brackets is that of the second premolar, both upper and lower, in treatment of the type of malocclusion which demands the removal of first premolars. Treatment is often instigated at an age when these teeth have been in eruption for only a short time; consequently their clinical crowns are short, often so short that in order to locate a bracket in a position that would be properly related to that of the cuspids and incisors, it would encroach upon the soft gingival tissue. Without special attention to locating these brackets, they will invariably be placed too near to the height of the buccal cusp. If this is permitted to happen, every arch wire from the beginning leveling arch to the ideal finishing arch would necessarily have to carry an offset occlusal bend in order to compensate for that specific error. Should this not be done, the second premolar would occupy a position gingival to the desired occlusal plane. It seems that all stress of accuracy has been placed upon the arch wire to bracket fit and is calculated in half-thousandths of an inch and that the relative placement of the brackets is permitted to vary in millimeters. It is certainly obvious that if the mechanism is to perform in the highly desired precise manner, bracket location must be accomplished with relative precision.

An observation of the buccal surfaces of the posterior teeth reveals the fact* that the occlusal gingival curve of these buccal surfaces will vary according to the different types of tooth pattern—that in normal occlusion there will be a gradual increase in the lingual inclination of the teeth as they proceed distally from the incisors, also that for a uniform distance from the crests of the cusps there will be a relative and equally progressive torque requirement for an ideal arch during treatment. Torque for this section, which has been described as continuous torque, is proper, and must be coordinated with the normal inclination of these buccal surfaces, both upper and lower. Failure to do this will cause an undesirable buccal tipping of all posterior teeth. This practice has caused the appliance to be condemned by some orthodontists as a "glorified expansion arch E."

In treatment of malocclusions in which requirements demand the sacrifice of dental units in order to correct them, special attention must be given to the torque requirement at the position of the bracket of the tooth distal to the space that has been created, so that the buccal-lingual axis of this tooth will be such that its occlusal surface will harmonize with the teeth distal to it, and permit function of its cusps during mastication.

Another attachment, the correct position of which is often neglected, is that of the buccal tube on the molar band. If not located so that it has the harmonious relationship, both from the height of the cusp and its relationship to the buccal surface of the tooth, one cannot expect anything but trouble. It is un-

*Recently verified by Dr. Gilbert Miller, Department of Orthodontia, University of California.

desired movements of these molars which, through cusp interference, cause, for convenience, the development of cross-bite, open-bite, and other troubles whicl are most difficult to overcome. Tests for proper molar tube locations have been adequately described in the literature[3] regarding the use of both ribbon arch and the edgewise appliance, and a rectangular arch wire should never be tied to place without first undergoing these tests.

In conclusion, the orthodontic profession has come all the way from inefficient, completely removable appliances to streamlined mechanisms which can. through attachments that fit arch wires accurately, dictate exactly the position and axial inclination of every tooth in each dental arch. Yet orthodontists voluntarily, if not altogether consciously, withdrew from this state of supposed technical perfection by deliberately using arch wires which failed to fill the slots of the brackets. Can this prevalent tendency be entirely without foundation in consideration of physiology, as well as in ease and perfection of orthodontic treatment?

Since the time it was introduced, the edgewise mechanism has received no major changes. Many attempts have been made to change the design of the appliance so that it would be simpler to handle, but all have been based upon the same bracket principle, a rectangular arch wire in a rectangular bracket slot.

In speaking of mechanics, it is often said of Dr. Angle that he would never have been satisfied with what he called the "Latest and Best." No doubt, that is true. I believe, however, that he would have directed his efforts toward answering the physiological requirements, for his method of appraising appliances was first, physiology, second, mechanics, third, art.

Abandoning for a moment the discussion of orthodontic treatment in terms of specific means for attaching teeth to the arch wire, what might be set up as the desiderata of the ideal orthodontic appliance? Disregarding the probability of ever obtaining such a mechanism, one might say that the ideal appliance would permit every tooth the independence of movement afforded in a mouth where occlusion is normal, and where no appliances are present, that it would *influence* each tooth to its proper position without inexorably *moving* it there, that the motive force for this change in position would come from mastication, and that tooth movements in a desirable direction would be given complete freedom, while undesirable movements would be gently but firmly opposed.

The concept of driving this chief motive force for the correction of malocclusions from mastication is not so farfetched as might be supposed; the forces of mastication operate under any plan of orthodontic treatment, although not always in desirable ways.

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3408 WEBSTER ST.

T. WINGATE TODD: CATALYST IN GROWTH RESEARCH

WILTON MARION KROGMAN, PH.B., M.A., PH.D.,* PHILADELPHIA, PA.

DR. TODD brought to orthodontics the same concepts he brought to growth, generally: the dynamics of progressive unfolding, rather than the statics of the single biological moment. He brought the idea of the passage of time, rather than an isolated observation, as the basis of diagnosis and the rationale of treatment. It is natural, therefore, that he brought to orthodontics the principle that the *whole growing organism* must be considered in treating one of its parts, e.g., the dentofacial complex.

Growth, for Dr. Todd, was a very intricate process. In 1932 (b) he stated that it involved three concepts: (1) increase in dimensions; (2) change in proportions; (3) adjustment of parts. He went on to say that perhaps increase in dimensions might be considered as *growth*, per se, while change in proportions and adjustment of parts might be considered as *development*. To the whole he gave the name "developmental growth." In the same year, however, he went on to introduce a further idea, when he defined *development* as "modification of proportion with increasing maturity." The theme of adjustment was extended to include *differentiation*, "expressed as local growth in dimensions with consequent readjustment in relation to the several structural parts involved." In 1937 (b) he observed, "Growth is increment, but growing up is differentiation." In another article in the same year (1937) (c) he observed that "growth is merely the increase in bodily size or bulk." But even as early as 1929 he had realized the dynamic aspect of growth when he said that it "consists of two processes, addition of substance, and abstraction of substance."

Out of this unfolding of ideas and concepts came Todd's basic premises: we *grow* (increase in size); we *grow up* (change in proportions); we *mature* (the passage of biological time in the tissues). The harmonious and uniform interplay of *all three* may well be included under his category "developmental growth." The necessity for *all three* to be considered jointly is signalized by Todd in his 1937 (c) observation about the insufficiency of dependence upon only part of the picture. He said, speaking of height and weight as measures of growth, that "ratings (in these dimensions) tell us merely how far the child has fulfilled what may reasonably be considered his full potentiality of growth. They give us no indication of whether his rate of growth is satisfactory." The latter appraisal can come only when degree of maturity is determined.

In studying growth Todd made some of his greatest contributions to orthodontics by his analysis of age-changes in the skeleton (*vide* his masterful summary of ageing in skeleton, locomotor system, and teeth, 1939b). His basic feeling (1929) was that "bone . . . is a living tissue subject to constant change."

Read before the fiftieth anniversary meeting of the American Association of Orthodontics Louisville, Ky., April 23-26, 1951.

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This idea of constant change, which is another way of saying developmental growth, early led him to study the phenomena of bone repair as an illustration of bone growth (1926). In his matchless collection of Primate and human skeletal material he observed, grossly, that bone growth (especially in the skull and face) is accompanied by "bone-pitting" which he concluded was due to hypervascularity (see 1929); this, in turn, he felt to be a sign of vigorous growth action. It was in this year that he stated that "interstitial growth of bone is specially characteristic of the jaws" (1926).

The problem of *bone density* concerned Todd very much. He felt (1933) that an evaluation of bone density was important in an estimation of "mineral reserves" and of "the mobilization of minerals" in the body. More particularly, he tried to use the x-ray as a measure of *demineralization* in constitutional inadequacy or in ill health. Poorly mineralized (constitutional) or demineralized bones (ill health) he felt to involve poor orthodontic risk. In 1937 (b) he stated as follows: "When poor mineralization is present in the bones of the hand one may properly suspect it also in the jaws. It means that the process of remodeling of the bony alveolus, relied upon by the orthodontist for establishment of permanence in the new positions into which he has brought the teeth, is ineffective. As soon as the orthodontic appliance is removed the teeth will revert to their original position, or worse still, will be unstable in alignment and assume new positions of malocclusions."*

In an attempt to standardize the evaluation of mineralization Todd introduced "The Western Reserve University Density Gauge" (1937d). This is a series of 10 plates of pure hard aluminum, each 1 mm. thick, arranged in a stepladder overlapping order. Todd warned that the gauge "is not used to detect directly the mineral density but to control the processing so that the bone texture of one roentgenogram can be checked against that of another."† Todd used the gauge in the clinical evaluation of bone, muscular tissue, intermuscular and subsynovial tissues, and subcutaneous tissue and skin (1937d).

In his thinking about bone growth Todd reserved a special place for the *mandible*. In 1929 he said, "The mandible is apparently a very simple bone . . . but probably there is no bone which is more complex in its development and its growth. . . ." In 1930 (b) he went on to say that "the problem of mandibular growth . . . is one of the most elusive, though important, of all skeletal problems."

With the material and equipment at his command Todd was never quite sure how the mandible grew. In 1930 (b) he wrote as follows: "It is quite clear, however, that since the mandible, shaped like the letter *L*, encompasses, by its two limbs, the developing maxilla with its premaxillary and palatal bone annexes, vertical growth in the latter must be paralleled by growth in the mandibular ramus and antero-posterior growth by extension of the mandibular body The well-recognized changes in form at the region of the angle are part of this adjustment. Impulses of growth are not always accurately adjusted, and de-

*It is to be noted that myofunction is not considered in this picture at all.

†The Mack-Brown Electronic Densitometer (The Pennsylvania State College) now rates bone density directly.

fects are manifest in various degrees of disharmony." This implied growth reciprocity between upper and lower jaws is not borne out in a later (1934c) study of the cephalofacial growth of thyroidectomized sheep. It was reported that "the upper jaw exhibits defective growth in maxillary tuber and still more in the anterior region or 'canine' area of maxilla"; yet "there is no demonstrable defect in mandibular growth." It is likely that we may interpret this apparent discrepancy on a "timing" basis, i.e., the growth relationship (or lack of it) is a function of the time when growth occurs in the two areas, or when the growth pattern is interfered with (as in the sheep).

The *temporomandibular joint* was approached by Todd almost wholly from a comparative morphologic viewpoint, as exemplified in his 1926 and 1930 (b) papers, especially the latter. From an analysis of the joint in Carnivores, Herbivores, and Primates he concluded that "the human condylar and temporal articular contours are not reciprocal in shape." He felt that the joint in Man was a combination of gliding plus hinge action (with the first action basic) and that in masticatory movements "the (action of the) temporo-mandibular joint is almost negligible." He observed, however, that "the movement at any joint is a specific problem for each individual . . . ," thus paving the way, as it were, for later morphofunctional analyses in individual instances.

In Todd's hands the concept of *skeletal maturation* came to full bloom. The idea of biological time was not original with him, but his researches on the skeleton gave the idea form and substance.

The study of "bone age," "carpal age," "skeletal age," to use but a few synonyms, was the great theme of Todd's growth research, culminating in 1937 (f) in his classic atlas of hand x-rays.

Many moot points were clarified by his work on skeletal maturation, e.g., sex differences. In 1931 (a) he set up sex patterns somewhat as follows: up to 6:0 sex differences are slight; from 6:0-8:0 the female is ahead; from 9:00-10:0 there is a measure of equality; between 10:0 and 13:0 girls mature at such a rate as to be advanced almost 2:0; by 17:0, males have caught up, and the two then go on pretty much alike. In the same year he pointed out that an individual child advanced in height and weight growth also tended to be skeletally advanced, though the latter advancement will not exceed nine months to one year. Further, there are no significant race differences (white and Negro).

Todd made one observation that is vital to orthodontics. In 1930 (a), upon the basis of examining Anthropoid skeletal material, he said that "tooth eruption and epiphysial union progress together, and . . . their inter-relationship is similar to that shown in human skeletons." In 1932 (b) he quoted Broadbent as finding "that a child which is retarded in skeletal growth is usually also retarded in tooth development." In support of this generalization Todd reported (in the 1932b report) on a study of craniofacial growth in children, using skulls. He noted that "a dead child is a defective child" and to him this accounted, in part, for the "disorderly" growth patterns to be found. However, when the data were aligned upon the basis of "the stage of developmental progress" (i.e., skeletal age) research order emerged from apparent growth chaos: dimension, proportion, tooth eruption, all fell into some semblance of sequence—bio-

logical, not chronological, time was the open-sesame that turned the lock. In this study, at least, all growth variables seemed to be linked to skeletal age.

One point that Todd stressed is worth noting here. In the 1932 (b) study he observed that growth of bones in length is "a measure of progress toward adult size," while "the appearance of ossification centers, the penetration of cartilaginous epiphyses by bone, and the final union of epiphyses with the bone shafts are measures of developmental progress." Here, again, is the apparent dichotomy between growth (size) and maturation (development).

It must be obvious that *growth-time* looms up as very important in Todd's thinking. His insistence upon biological time as the real basis of comparative growth (in a serial sense) has been noted previously herein. But now let us look at another aspect of the problem, i.e., the problem of timing with reference to possible interference with the facial growth pattern. In 1935 he said, "Of all bodily areas where the accentuations, warpings, bias, disturbance, inhibition or annihilation of the developmental pattern may find expression, the face is by far the most sensitive." In 1937 (b) he further observed that "all rapidly growing structures are vulnerable and hence it comes about that facial growth is in greatest danger of mutilation during the first year." Parenthetically, Todd felt that malnutrition, rather than illness, was the most serious attack upon the time-vulnerable growth pattern.

While he felt that biological time was basic, yet Todd did not "miss the bus," so to speak, in facing the necessity for expressing time in chronological units. In other words he translated biological time, for the practitioner, into more conventional time-units. It will be instructive to look at some of his statements (1930b).

In the palate, at molar level, transverse growth is five-sixths completed by 4:0, total, by 6:0; at bicanine level it is not completed until 12:0. Todd felt that the length growth of the palate "follows and is conditioned" by the developing deciduous arch, and later by the permanent molars (1930b). Interestingly enough, Todd suggested the independence of palatal (endo-oral) and facial (ecto-oral) growth by observing that bizygomatic breadth continued to increase until at least 17:0.

In the face Todd differentiated mainly between vertical and horizontal growth (using the latter with particular reference to the sagittal or anteroposterior plane). He felt quite strongly that there were "spurts," or accelerations, in growth. Table I is a schematic tabulation of his main "periods" of growth, and the principal plane involved.

This sort of thinking implies a different (genetic ?) growth-gradient and growth-time in the two planes analyzed. Todd emphasized this when, in 1929, he said, "Growth of the face comprises increase in dimension, unequal in extent and nonsynchronous in time . . . this means endless adjustments in the skeleton of face and cranium." In 1930 (b) he said it more simply, "Growth is discontinuous." For example, in the total face there were maxima at B, 0:6 (for deciduous teeth), 4:0-7:0 (for M1-2), and at 16:0-19:0 (for M3). When these periods are broken down for plane of growth, maxima in *vertical* facial growth are found at B-0:6, 3:0-4:0, 7:0-11:0, and 16:0-19:0.

The relation of cranial growth to facial growth was always uppermost in Todd's mind.* In 1932 (a) he pointed out that brain growth is 1/5 adult size at birth, ¾ at 2:0, and ⅚-⅞ at 6:0. This conveys an idea of the speed of vault growth. "This speed ensures," said Todd, "early craniofacial expansion. . . . The extra space needed for backward extension of the dental arches to accommodate the full permanent dentition is easily obtained as a result of the carrying forward of facial mask by expanding brain case."

TABLE I

AGE-PERIOD	VERTICAL	HORIZONTAL
B – 0:7	Some	More (For the deciduous teeth)
0:7 – 2:0	Little	None
3:0 – 4:0	More (For M1)	Some
7:0 – 11:0	Some (Rather even downward and forward growth for M2)	Some
11:0 – 16:0	Very little	Very little
16:0 – 19:0	Some (As in 7:0 – 11:0, though not so marked; for M3)	Some

While we are on the subject of "timing" let us see what Todd did with *adolescence*. He is apparently not quite sure how to define it. At one time (1930a) he said it "is a figment of the mature imagination." At another (1932a) he defined it as "merely the inception of adulthood," or in broader terms as "a period of adaptation to the conditions of adult life and culture. . . ." Adolescence is, in Todd's thinking, biocultural. On the more purely biological side (1932a) he observed as follows: "The character of adolescent developmental growth presents no special features beyond those inseparable from the blossoming of sex. It is true that special hazards arise from the altered character of growth, from the adjustment of bodily functions, and from psychic, emotional and social readaptations. The occurrence of thyroid dysfunction, of increased susceptibility to fatigue, of tuberculosis, the lighting up of old infections and aggravation of cardiac disease, are common accompaniments of this period."

The "whole child" concept is embraced by Todd under the term *constitution*. Nowhere is it precisely defined, but time and time again we are led to assume that it is the biogenetic growth potential of the child; it is, in effect, what the child *is* when both heredity and environment bless him with favorable circumstances of conception and developmental growth.† In 1935(a) Todd made this statement: "Constitution in the child implies indeed the maintenance of an orderly pattern of developmental growth. If this is disturbed, we say that constitution is affected. If the pattern is thrown out of balance and permanently warped, we say the constitution is undermined. If the pattern is destroyed beyond hope of restitution, we say the constitution is shattered." The constitutional interfer-

*Space does not permit detail, but mention must be made of the far-reaching comparative craniofacial studies carried on under Todd's direction: guinea pig, hyena, pig, deer, baboon, macaque, gibbon, Orang, chimpanzee, gorilla. All mammals were grist in his research mill!

†Constitution is that with which a well-born and well-reared child is endowed and which he possesses during the developmental period.

ences, these "deviations from metabolic integrity," as Todd (1938) called them, are registered in impaired growth increment, skeletal maturation, and bone texture.

To the orthodontist the concept of the child's constitution, whether normal or abnormal (as he usually sees it), is very important: it is a factor to be considered in the localized imbalance that has resulted in a malocclusion; it is a factor in the growth process that, it is hoped, may be an aid to therapy; it is a potential factor in the mineralization of the (alveolar) bone that is the locus of the movements of orthodontic stresses. So, we have a veritable trilogy: locale of deviation; growth vigor; bone response. These are all possible factors in orthodontic therapy, and all are founded in the constitutional status, and progress, of the individual child.

There are certain variables that may condition the constitution. Among them are illness, per se, endocrine imbalance, diet, and heredity. Todd was cognizant of their presence and influence, of course, but he did little original work with the first three. For the effects of illness he relied on the work of the Bakwins; it is true that he did one piece of work on the endocrines, viz., the thyroidectomized sheep; on diet we may consider his studies of the gastrointestinal tract as secondary, rather than basic; under his direction Venar and Zuck carried out several feeding experiments with a view to studying the mineralization problem, but Todd followed the work of Sherman closely. One statement by Todd is worth quoting: "Good nutrition, though usually measured by weight, is best expressed by well-being" (1934a).

In the realm of heredity Todd made a real and enduring contribution by developing the "family-line" concept, of "tall," "average," and "small" growers. In 1935 (b) he said, "The most practical way to look at heredity today is not in genealogies of feeble-minded or physical defect, but in the family-line patterns. Heredity is a broad stream, and these formative influences inherent in our genes allow us plenty of latitude. Hence there are marginal members in most families, outsize or peculiar in gait, habit or attitude, persons to whom a double portion of inheritance has been allotted." But he recognized the tough problem of delineating family-line influence when he said (1932b), "The deeper we probe into the subject of growth the more confused we become in our attempt to segregate out the influences exerted by heredity and by environment."

Todd did more than contribute concept and philosophy; he contributed technique as well. Specifically, for the study of the growth of the craniofacial area he developed the widely known *Reserve Craniostat*, the forerunner of the cephalometer. To aid in studying cephalofacial growth he developed the *Reserve Headspanner*, the instrument so effectively used by Hellman in his researches. These instruments, by their very natures, provided little more than external dimensionality. That, Todd knew, was not enough. In 1926 he voiced discontent almost to the verge of disapproval and despair: "How is one to ascertain by measurement the amount of growth? It is quite a difficult matter, and I do not know any instrument which will do it accurately, because, of course, you have to allow for antero-posterior and also for transverse changes. I know of no instrument which will permit that.

"If one finds it extraordinarily difficult to do on the skull, it must be impossible to do on the living individual. I have tried with various forms of apparatus which have been designed, but I am not clear that I have really got accurate measurements. Now what is one going to do about it? I am a little doubtful in my own mind as to whether the time is ripe for the measurement of the living individual. No doubt we shall go on trying to measure the living individual, but until we can get some way of measuring antero-posterior growth and transverse growth also, and do it accurately, we shall not get very far, because the amount of growth is really very small and the observational errors are very large."

These were the thoughts of a man who had a never-say-die attitude. Even as he wrote the x-ray was at hand to provide its deep-penetrating insight. Todd really exemplified his own words when he said (1932d), "No really scientific work is easy, and patience equals faith as a qualification in taking up the task." Todd lived to see the Broadbent-Bolton roentgenographic cephalometer as the answer and solution to his perplexity in the troubled hours of 1926.*

"*Ideas,*" said Todd in 1931(b), "are working hypotheses: they have temporary and fleeting significance. . . . *Idealism* is broad, and links together all truly constructive workers by its very comprehensiveness." Ideas he shared lavishly, idealism he inspired by precept. Those of us in the field of growth may testify that it was not the ideas, per se, that achieved the immortality of continued challenge, but rather the goals envisioned in the ideas. In this sense ideas are tools, idealism the approaches.

Todd set his sights high. Not for him the fiftieth percentile as a static—average—concept, but rather the eightieth—the optimum—as the level of attainment. Here is how he put it (1932b): "It may well be that the maximum possible growth in any arbitrary unit of time is not the optimum growth, but, failing a knowledge of what the optimum may be, we have had to substitute the average with its statistically derived error, which is, of course, an arbitrary figure defining the range of a sample gathered in as random a manner as possible. From a biological point of view this is unsatisfactory. What we really want to know is the growth which would occur under optimum conditions. Then, and only then, can we measure accurately the deviation therefrom in any individual."

Todd had a beautiful literary style. For his aim in his over-all growth approach let us observe the following lyrical passage (1937a) which expresses the optimum biopsychological endowment: "Stature within reasonable limits; weight that means energy and not encumbrance; physical development to match experience, and experience to match years; flexibility of imagination; well-disciplined thought; good power of attention and concentration; the ability to discern broad connections; fertility in resource; catholicity in cultural appreciation; artistic capacity; instructive grasp of timeliness and propriety; intellectual

*A new set of problems beset Todd, i.e., those concerned with superposition. He regarded a given plane as resulting in a spurious pattern-alignment, "a kind of a fiction" (1930). In 1934 he observed, "It goes without saying that there can be no one basis of superposition." Further than that he did not elaborate.

and social adjustment to the ways of others; unerring sense of responsibility to the ideal which beckons ahead. Happy the boy or girl who can thus qualify as captain and master on setting sail!''

What message had he for orthodontics? It is twofold, the first passing on the torch of research in orthodontics; the second a recognition of orthodontics as a scientific discipline in its own right.

In 1932(b) we read as follows: ''To Dr. Broadbent, as Director of the Bolton Study, passes the responsibility of carrying on the intensive investigation of facial and dental growth in children, in the group research now being prosecuted in our Institution. . . . Such mantle as I have had I throw over his shoulders, though even now that mantle has shrunk to but a scantling through the vigorous growth of the truly orthodontic shoulders upon which it has fallen.''

In 1939(a), in an article published a few months after his untimely death, he evaluated orthodontics in these words: ''Orthodontics is a science which has now passed through its preliminary analytic phase and becomes a field for the patient, meticulous study of unit problems, preliminary and basic to the synthesis which is the goal of all biological science.''

May orthodontics, in the second fifty years of this Association, live up to that standard!

TRIUMPH

The tongue of voiced thought
has not been muted—
It echoes in the reverberations
of Truth set free.

The eyes of vision
have not been dimmed—
They are sighted
on the ageless stars.

The wings of fancy
have not been clipped—
They are freed to soar, untrammeled
by limits of mortal will.

The vigor of unfettered spirit
is undiminished—
It is our heritage, and
it belongs to the ages.

—W. M. Krogman
1951

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ANCHORAGE AND THE MANDIBULAR ARCH

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THE efficiency, strength, and constancy of any construction depends upon its foundation. One of the major current problems that confront us as orthodontists is the stability or lack of stability of the mandibular arch in its employment as anchorage in the treatment of cases either of maxillary protraction or mandibular retraction. Numerous seemingly successful cases have resulted as disappointments because of this particular problem.

The following statement is a quotation:

"In planning a mechanism for moving teeth one of the main points to be taken into consideration is enduring, firm anchorage. In my own practice, I always include for anchorage all the teeth that are practicable not only to prevent their being moved, but also to prevent soreness of the sockets."

That was written over sixty years ago by John Nutting Farrar. It is known that occipital anchorage was used over one hundred years ago, indicating that this subject was at least given some attention in the earlier days of our specialty. Nevertheless, when we review the very early methods of treatment and the precarious anchorage upon which many of them depended, we can certainly sympathize with the operators of those days.

In our modern concept anchorage has been defined as a "resistance to force" or "resistance to overcome an applied force." It has been stated the term "anchorage" is a misnomer for since we are discussing human tissues we cannot consider anything therein truly immobile when a force is applied to it. The term "resistance" has been favored. Both terms will be used interchangeably throughout this thesis. This is a really a mechanical terminology and we should consider the subject from a biologic standpoint as well. Physical laws may not apply in quite the same manner when referring to living tissue. Anchorage is not a mechanical entity for in orthodontics the very basis of the resistance is in the biologic make-up of the part involved. We tend to think of teeth as the only means to serve as units of resistance as the crowns go to form the required attachments. Actually, the true importance of the teeth in this instance is that they are attached to the bone by fibers of the periodontal membrane. Bone is, therefore, our true source of anchorage or resistance.

As we have improved in our technique and methods, we have naturally and rightfully become more critical of our results in our aim to approach more nearly ideal occlusion. Since we have become more critical the failure of our anchorage and its sequelae have become more apparent and more widely recognized.

Let us consider the fundamentals of this "slippage" or "skidding" or "collapse" of our mandibular dental arch. We are all familiar with Wolff's law which states, "Every change in the form and function of bone or in its function

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alone, is followed by changes in its internal architecture and no less definite alterations in its external architecture in accordance with mechanical laws." An erroneous interpretation had been made of this law to the effect that in Class II, Division 1 cases we could place the teeth in their proper positions and, by normal function, bone would develop and bring about an increase in size of the mandible. This does not follow as the amount of bone in any mandible is essentially of genetic origin. Its structure can and will change for bone is the most dynamic of all body tissues. It constantly will break down and rebuild through life. Oppenheim's experiments have shown that the architecture of bone can change from one that is designed to withstand the forces of mastication to one that is formed to withstand orthodontic forces.

We know that even with the placing of separating wires, changes are brought about in the bone surrounding these teeth. We come to the conclusion that a really true anchorage is not attainable in the mouth, particularly in the sense that the teeth form it. The teeth do serve as a means of attachment through the fibers of the periodontal membrane to bone which is our true source of anchorage. It would seem logical to employ as many of these attachments or teeth as possible for our anchorage, for the greater number used would naturally involve the more periodontal fibers attached to the bone that we require for the resistance desired.

When we are attempting to change arch relationship, we use intermaxillary anchorage, pitting one jaw against the other by means of elastics. We all know Newton's law of physics which states, "To every action there is an equal and opposite reaction." In the use of intermaxillary elastics, we have the fulfillment of this principle. There is an equal force at each end of the elastic pulling as hard one way as it does the other. There is going to be a force brought to bear and a potential movement in both arches. Theoretically, then, at least, the arch holding the appliance that is attached to, or utilizing, the greater number of teeth, periodontal fibers, and bone will have the greater resistance and be displaced to a lesser degree.

Let us now consider the various clinical signs of this collapse of the mandibular arch during the use of intermaxillary elastics. One common sign is the buccal displacement or mesial tipping of the lower first premolar. A variation of this may be noted with the buccal displacement of the second premolar. Another form is the mesial drifting or the forward tipping out of the mandibular arch of the canine teeth. This may also be seen as a mesial rotation of the canines. Another common sign is the crowding of the lower incisors. The tipping forward of the lower incisors or the actual bodily mesial displacement of the mandibular incisors is an additional indication that the stability of the mandibular anchorage has been overcome. The aforementioned signs are to be considered in the light as conditions produced during treatment, not as observations made on the original occlusion.

Among the more important mechanical factors influencing anchorage are:

1. The stability or rigidity of the appliance supplying the anchorage.

2. The amount of support the appliance receives from the structures to which it is attached.

3. The amount of force applied.
4. The direction of the tooth movement.
5. The number of teeth to be moved.
6. The distance the teeth are to be moved.
7. The muscular pressure involved.
8. The manner of interlocking cusps.
9. The passivity of the appliance.
10. Are the teeth which are depended upon undisturbed, for it is said that even a poorly fitting band can irritate the periodontal membrane, which would tend to affect the anchoring quality of the tooth?

The amount of interest taken in this problem and the means of combating it have been noted by me for several years. In order to gather more information and several opinions on the subject, a questionnaire was sent to a number of leading orthodontists throughout the country. This means was used to gather a cross section of modern orthodontic thinking along these lines. A sample of the questionnaire and a copy of the letter that accompanied it are seen in Figs. 1 and 2. Seventy questionnaires with accompanying letters were sent out. Fifty-eight of these were returned. No follow-up urging was done to stimulate the men to answer. As you can see it was left to the discretion of the man himself as to whether or not he wished to sign his name. The majority did. The percentage of responses from very busy orthodontists all coming without any urgency was most heartening. Not only is this an indication of the prevailing interest in the subject but it also demonstrates the continued spirit of cooperation and helpfulness that exists in the specialty. In addition to taking time to fill out the questionnaires, a large number of men wrote worth-while and informative letters. Several of the letters and comments would bear verbatim repetition but space will not permit this. After the correlation of the material gathered from the direct answers received, some of the accompanying comments along with my personal views on the subject will be included in the interpretation in order that the material be as concise as possible. Let us now consider the responses to the questionnaires.

1. *Type of Technique Followed (Edgewise, Twin wire, etc.).*—Twenty-two answered that they use the edgewise mechanism. Twenty-one answers came from men using the twin wire or Johnson appliance. Among the twin wire users several stated that they use some labiolingual technique, too. There were only three answers from men who use the labiolingual technique almost exclusively. There was one answer each from proponents of the open tube appliance and the pin and tube appliance. Nine men stated that they vary their techniques widely and choose the appliance that they feel fits each particular case. One man did not answer this question.

This demonstrates that the tendency is growing more toward some form of multibanded technique. This may not be a true percentage of what a national poll of orthodontists would disclose but it is an effective indication.

2. *Type of Appliance Used for Mandibular Anchorage.*—These answers followed the anticipated trend in that the edgewise men generally use the edge-

Dr. Wilbur J. Prezzano
Medical Centre
White Plains, New York

1. Type of Technique followed (Edgewise, Twin wire, etc.) .....

2. Type of appliance used for mandibular anchorage .....

3. Do you use any adjunct to your mandibular anchorage? .....

   If so, what? .....

4. Do you make use of head caps? .....

   In certain cases ..... In all cases .....

   Are you successful in getting cooperation from your patients in the use of head caps? .....

5. Do you measure the amount of force used in employing intermaxillary elastics? .....

   Do you vary this force or is it practically equal in all cases? .....

6. What do you consider the maximum amount of force applied by your intermaxillary elastics? ..... ounces.

7. Do you find that you get some forward slippage of the mandibular arch? .....

   Any comment on this .....

.....

8. Are you satisfied with your mandibular anchorage? .....

   Remarks .....

.....

.....

.....

Thank you.

Fig. 1.

wise arch while the others us lower lingual or whatever the particular case calls for. One edgewise man uses a lower lingual appliance and several twin wire followers use labial appliances on the lower arch, either banding or ligating the incisor teeth. Two men use soldered lower lingual appliances, one with stops between the premolars. Two use stabilizing plates.

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MEDICAL CENTRE
WHITE PLAINS, NEW YORK

October 28, 1950

Dr. John Doe
123 First Avenue
Boston, Massachusetts

Dear Doctor Doe:

One of the major current problems that confronts us as orthodontists is the stability or lack of stability of the mandibular anchorage we employ. Numerous seemingly successful cases have ended up as disappointments due to this particular problem.

Since I am preparing a thesis on this subject, I am sending the enclosed questionnaire to several leading orthodontists and am asking that they be kind enough to fill it out and return it. Your frank replies to the questions will be very greatly appreciated and I sincerely hope that this survey, which will be used in forming opinions for a part of the thesis, may possibly help our specialty, in some way, to improve the service we are rendering to our patients.

Very truly yours,

Wilbur J. Prezzano, D.D.S.

enc.
m

Fig. 2.

Here we all see that in the main, the exclusive practitioner of orthodontics tends to follow his technique quite regularly. However, there are indications that men are not depending entirely on a lower lingual appliance.

3. *Do you use any adjunct to your mandibular anchorage?* Of the fifty-seven men answering, thirty-seven stated that they do use some form of adjunct. Three others stated that they do, but infrequently.

It is to be noted that the majority of men, including those employing a full edgewise set-up, do use some aid to their mandibular anchorage or resistance. There are various types used and this seems to be a place where the orthodontist gives vent to his individuality. More will be said about this later.

4. *Do you make use of headcaps?* Twenty-seven men answered that they do use headcaps or headgear. There were several who stated that they use them in varying numbers of cases.

In addition, there were a few who stated very strongly that they do not use this means of anchorage. One man stressed his negative with exclamation points and thanked the Almighty that he did not have to ask his patients to do this.

From the further comment, it is obvious that the main problem with the headcap is enlisting the cooperation of the patient. The majority of men who answered that they do use headcaps seem to feel that they do get the necessary cooperation. Several stated that they had forsaken the use of this apparatus because of the difficulty encountered in getting the youngsters to wear them. As stated previously, there were only a few who disputed the value of the headcap in principle but several who felt that the burden of cooperation was a very great one.

5. *Do you measure the amount of force used in employing intermaxillary elastics?* Thirty-two answered that they do measure the amount of force. In fairness it should be pointed out that in addition a large number of these men may not measure the amount of force with a scale but have had so much experience that they feel they can depend upon that, which in many cases may be very true. A large majority of the men seem to vary the force according to the individual case and tolerance of the patient.

6. *What do you consider the maximum amount of force applied by your intermaxillary elastics?* These answers varied from two to ten ounces. One man stated that he uses thirty-two ounces on each side and still another stated that he uses thirty-six ounces. These last two refer, of course, to force attached to headgear or cervical anchorage. In my own practice, we start the use of intermaxillary elastics with a very light force of perhaps one to two ounces. If the case seems to be responding satisfactorily to this the force is not appreciably increased. In cases in which the teeth can be moved with a light force, the relative resistance is correspondingly less. A heavier force applied in instances that do not require it will more easily overcome the resistance of our anchorage.

It is my belief that any intraoral elastic pressure over four ounces is excessive. The extraoral pressure attached to the headgear that some of the men employ is truly amazing. When I discussed this particular detail of this presentation with a leading dental scientist, he stated that the breakdown and repair that must constantly take place as a result of these pressures is too much to expect of physiologic function.

7. *Do you find that you get some forward slippage of the mandibular arch?* There were eleven men who stated that they did not any forward slippage. All others stated that it was perceived at least some of the time.

This is an interesting response. The amount of perception of such a shifting would depend largely upon the observer. One man stated that he has noted it in possibly one case out of five hundred. However, it seems to be the consensus of most of the present-day orthodontists that this slippage cannot be fully avoided with the prolonged use of intermaxillary force regardless of the appliance.

8. *Are you satisfied with your mandibular anchorage?* Twenty-one answered in the affirmative, that they are satisfied. Twenty said that they are not satisfied. The remainder answered that they are not entirely satisfied.

It is quite apparent that many men realize that the relative resistance employed against the desired movement is not stable, but since it is the best yet available it must be accepted in a percentage-wise compromise.

We have reviewed the results of the questionnaire along with some of my own interpretations and comments. Now let us proceed to the means employed to aid our relative resistance and thereby diminish the problem of slippage of the mandibular arch.

There is no panacea for these ills. From all my reading, corresponding, discussing, and personal clinical experience it is apparent that we cannot completely overcome the shifting of our anchorage. We can, however, diminish it by various means. The choice lies with the operator depending upon the philosophy of the patient and the orthodontist, the exactness of the result desired, and the practical limitations of the individual case. Let us divide these aids into two types: the mechanical type and the theoretical type. The mechanical type will be discussed first.

The lingual appliance is probably used most commonly as the mandibular mechanical therapy in the treatment of Class II cases. The fixed or soldered lingual used by Dr. Joseph Johnson is probably more stable than the type that can be removed by the operator. It has greater rigidity due to the fact that it does not depend on the frictional attachments of tubes, etc. However, it, of course, has the disadvantage of not being easily removable for adjustments or hygienic care. The Mershon type of lingual appliance may not be quite as rigid but its stability and efficiency may be greatly enhanced if certain principles are followed. It should be made of a heavy material to prevent its being easily lifted by the tongue. I use 0.040 Williams No. 2 gold wire. The mandibular lingual appliance should be made so that it sets down very close to the gingiva of the anterior teeth. If it rests way up above the cingula, it will tend to slide up on the sloping surfaces. I use a type of half-round post that has an attached sleeve which fits over the arch wire and when soldered to it, it greatly strengthens the arch at its most vulnerable point, the area just anterior to the post. Not only does this make the arch more stable but it practically eliminates breakage. Lifting of the arch or breakage are the causes of a great deal of anterior slippage. Another aid in preventing these difficulties is the use of a habit-breaking spur

soldered on the gingival aspect of the anterior section of the arch. This need not be sharp. It simply causes the tongue to slide over the arch rather than catch under it and lift it out of place. Many men ligate some of the teeth, either incisors or premolars, to the lingual appliance. This is of some assistance but the general consensus in modern orthodontics seems to indicate that the lingual appliance alone will not afford sufficient support when intermaxillary elastics are being used. Most operators who are using a lingual appliance use some form of mandibular labial arch in conjunction with it. This includes the employment of a twin wire labial appliance to which the incisors are ligated or to which they are attached by bands. During a recent visit to the office of Dr. Andrew Jackson, I saw demonstrated the use of a light gauge labial appliance with springs attached which were engaged under spurs soldered to lower canine bands. This has the effect of a torque on the long rooted canines and tends to serve as added support to the entire arch.

The edgewise arch with its engagement of all the teeth in the arch should certainly give a nearer stable support. It must be remembered, however, that in order to set this construction up, separation must be established between all the teeth, which tends to affect all the periodontal fibers and thereby disturb the original stability of all those teeth.

Headcaps or headgear seem to have returned to use in recent years. It would be hard to argue against the principle of extraoral anchorage. The great difficulty is to get the cooperation of the patient. It is impossible to do this unless the operator himself is convinced of the necessity and usefulness of the apparatus. I have been successful in the use of headcaps only in selected cases. In those cases they have worked very satisfactorily. We cannot wholly dismiss the thought that we might be expecting a little too much of an adolescent who is already wearing appliances, elastics, and keeping regular appointments. The parent of any modern youngster between the ages of 12 and 17 is well aware of the number of other activities and interests that are being experienced during that same period. We do not want to encourage resentment of the treatment.

Another means of aiding the stability of the mandibular dental arch is the use of a semifixed acrylic plate. This can be made with attachments to fit into half-round tubes that have been soldered to molar bands. This can be removed for hygienic care and is worn whenever the elastics are worn. This method has been used with considerable success by Higley, Bedell, and others who have introduced their own variations. This is not as troublesome as the headgear and appears less annoying to the patient. It gives further support than either a lingual or labial appliance since it is tissue bearing as well as tooth bearing. Fabricated in acrylic it is simple to keep clean. It is my opinion that this type of support can be very valuable in the treatment of Class II cases.

It was stated earlier that we would discuss some theoretical aids in preventing excessive slippage of our lower dental arch. Possibly we should refer to these as diagnostic aids.

The means we have discussed most in recent years is that of resorting to extractions. More than one thesis could be written on this phase of the subject. However, where there has been an anterior shifting of the buccal segments pre-

vious to treatment we can, in many cases, resort to extraction and thereby diminish the prolonged use of intermaxillary force. I would probably be classified on the conservative side regarding extractions, but in several cases in which the mandibular buccal segments have shifted forward, causing the canines to slip anterior to the regular curve of the arch, and there is an accompanying maxillary protraction, the extraction of four premolars along with general alignment of both arches and their relationship has been successfully accomplished. This shows to greatest advantage where the aforementioned shift has taken place and the mandibular incisors have remained in their proper position on the ridge. Extraction can be a tremendous aid in these cases.

Another theoretical or diagnostic aid is the consideration of early treatment. Dr. James McCoy divides the dental arches into five segments; one frontal composed of the incisors, two lateral made up by the canines and premolars, and two posterior which include the molars. He states, "By controlling these segments at the proper time, and here we have dental age to deal with rather than chronological age, we can cause a human denture and its supporting structures to assume normal relationships and continue their progress toward maturity." His conviction is that the suitable dental age for orthodontic treatment is during the eruptive stage of the canines and premolars. He feels that treatment at this stage makes the treatment period shorter and the results more positive.

In this consideration of aids to our prevention of loss of anchorage we must not omit the avoidance of attempting to move too many teeth at one time. Dr. Lowrie Porter has brought this out on numerous occasions. He advocates the use of sectional arches to move the upper molars and premolars in a posterior direction. In this way he avoids pitting the entire maxillary dental arch against the mandibular resistance. Along this same line, I consider it hazardous to move all six anterior teeth back at the same time. This is particularly true where a maxillary protraction exists and two upper premolars are removed with no extractions in the lower arch. It seems quite simple to move the upper anterior teeth back part of the way and then complete the closing of the premolar space by allowing the second premolar and molar to come forward into a functional occlusion. The only trouble is that during the use of intermaxillary elastics to bring those upper anterior teeth back you may pull the condyle out of its true centric position and later on, after the premolar space has closed, the mandible settles back into true centric position and you are left with an embarrassing overjet. It is considerably more judicious to move the canines back first and follow this by moving the incisors back.

In this thesis, I have attempted to crystallize the varied thoughts on the subject of mandibular resistance in modern orthodontics. It is a phase of the specialty, as was written earlier, that has stimulated my interest and concern over a period of years and I have welcomed the opportunity to delve more deeply into the problem. The thought is not held for a moment that this settles the problem for all time. As we go on, more and greater progress will be made. Further, every case is an individual one in regard to anchorage as well as treatment. As we approach more nearby ideal anchorage we shall approach more nearly ideal orthodontic results.

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MEDICAL CENTRE.

DECIDUOUS DENTAL ARCH WIDTHS AND WIDTHS OF THE FACE IN EARLY CHILDHOOD

THOMAS XAVIER O'REILLY, WHITE PLAINS, N. Y.

INTRODUCTION

APPRAISAL of the development of any child poses such questions as: "Is this an average child?" "Has growth proceeded so that it falls within the zone of variability found in normal, healthy children of the same age and sex?" "Is the child precocious or lagging in progressing toward the attainment of his predicted growth?" In answering these questions standards derived from random samples of children are helpful. As with the rest of the body, this is true of the face and dental arches.

PURPOSE

The central purpose of this study was to obtain measurements and prepare standards which would be useful in judging the development of a child's dental and facial structures. With this in view, data were gathered for selected widths of the dental arches at certain childhood ages and for the bigonial and bizygomatic face widths at the age of 5 years.

More specifically the aims of the study were:

1. To obtain central tendency and variability values for three interlingual widths of the upper deciduous dental arch (intercuspid, intermolar I, and intermolar II) at successive annual ages from 4 to 7 years and for the lower deciduous dental arch at the age of 5 years. This aim sought the answer to such questions as: "What is the average distance between the lingual surfaces of the upper deciduous cuspids in the 4-year-old white child of northwest European ancestry?" "Is the width the same for both sexes or does the typical boy have a wider dental arch than the typical girl?" "Within what limits are healthy, dentally normal 6-year-old children dispersed above and below the mean for different arch widths?" "Are there increases in the mean measurements for boys and girls of the three interlingual widths of the upper deciduous arch from 4 to 7 years?" "If there are, do boys show a greater increase than girls?"

2. To determine biennial increments from 5 to 7 years for the three interlingual widths and to analyze each series of increments for central tendency and variability. Here, the questions to which answers were sought were of the following order: "What is the typical gain in the intercuspid width of the upper deciduous arch between 5 and 7 years of age?" "Do boys tend to make greater gains than girls?" "How much do the growth increments for different individual children deviate from what is termed the zone of average increment?"

3. To discover the degree of relationship between widths of the face and widths of the deciduous dental arches in children 5 years of age. This aim had

This thesis was submitted in partial fulfillment of the requirements for the degree of Master of Science, in the Department of Orthodontics, in the Graduate College of the State University of Iowa, August, 1950.

two aspects. The first was that of determining the extent to which a wide upper deciduous dental arch is associated with a wide upper face (bizygomatic diameter) and a narrow arch with a narrow face. The second aspect was that of making a similar study of the association between width of the lower face (bigonial diameter) and widths of the lower deciduous dental arch.

SUBJECTS

The subjects were drawn from children enrolled in the Facial Growth Study of the State University of Iowa.* There were a total of 130 children (67 males, 63 females). Eighteen of these children had been examined at one age, forty-two at two ages, forty-nine at three ages, and twenty-one at four ages. The parents of the children were approximately 95 per cent of northwest European ancestry and of above-average socioeconomic status (largely members of the professional, managerial, commercial, or skilled trade groups). Acceptance of the children in the Study was in no way related to their dental health. It is the practice to enroll children in the Facial Growth Study at a sufficiently early age to make possible a complete initial examination prior to the child's fourth birthday. Until 5 years of age children are examined every three months, and thereafter semiannually. For various reasons such as transfer of residence, not having reached 7 years of age when the data were tabulated, or absence of a tooth, the number of records at different ages varies.

DATA

The following materials, always acquired within a week of each child's birthday, were procured from the files of the Study:

1. Casts of the dental arches.
2. Standardized posteroanterior cephalometric x-rays.
3. The anthropometric measurements of bizygomatic dimensions.

Impressions of the dental arches were taken with alginate material and poured with "Snow White" plaster. The arch widths were measured interlingually on these casts at three pairs of points which gave the shortest distances between the coronal portions of the deciduous cuspids and molars. They have been designated as intercuspid, intermolar I, and intermolar II diameters, and will be referred to as such. A gauge with vernier calibrations was used. The same measurements were repeated at least a day apart and careful precautions set up against bias. For the readings that differed by only 0.1 mm. the higher reading was alternately selected with the lower one. If the difference between the first two readings was 0.2 mm., the readings were averaged. If the first two readings were farther apart than 0.2 mm., a third was made. When the third was a repetition of either of the first two, it was accepted. Otherwise, the three were averaged. All computations were done with a calculator and checked.

The standardized posteroanterior cephalometric x-rays were taken with the Higley head positioner.[1] The bigonial dimension was obtained from them by measuring the broadest point in the area of the gonial angle while the x-ray

*A long-term research program begun early in 1946 under the direction of H. V. Meredith and L. B. Higley.

was resting on a lighted tracing table. Three readings were taken with the same gauge used on the casts with similar precautions and averaged. Again computations were done with a calculator and checked.*

The anthropometric measurements of the bizygomatic dimension were taken from the files of the study. These data were obtained by the following procedure: Two trained anthropometrists each determined the bizygomatic diameter, and in cases in which their records differed by more than 1.0 mm. additional measurements were made. Correction of all readings was made to the nearest half millimeter. This degree of rigor was maintained throughout in order that the results from each examination would closely approximate true biologic values.†

ABSOLUTE MAXILLARY ARCH WIDTHS AT THE AGES OF 4 TO 7 YEARS

Table I contains the results from analysis of the upper deciduous arch at the ages of 4 to 7 years. Displayed in the table are two measures of central tendency (mean, median) and four values describing variability (minimum, twenty-fifth and seventy-fifth percentiles, maximum).

Central Tendency Findings.—The typical boy has a wider upper deciduous dental arch than the typical girl. This is evidenced by the mean values for all three interlingual widths at each of the four ages. Besides boys having the greater mean value in every instance, the sex differences are larger from cuspid through intermolar II. Moreover, the amount by which the mean value for boys is larger than that for girls increases for each width with age.

Both boys and girls show an increase in mean values with age for the three dimensions with the boys having a greater increase in every subgroup. Over the three-year period the intercuspid width means increase 2.3 mm. for boys and 1.4 mm. for girls. During the same period the intermolar I width shows an increase of 2.0 mm. for boys and 1.0 mm. for girls. Similarly, the mean for the intermolar II width is higher at 7 years than at 4 years by 2.7 mm. for boys as compared with 1.5 mm. for girls.

Variability Findings.—On the assumption that the central 50 per cent of the subjects represent the "average zone," this zone is proposed for use in determining whether a child has average development of his deciduous dental arch. For example, with regard to the upper intercuspid width at 4 years the limits of the zone for boys are 20.8 and 23.5 mm., while for girls they are 20.2 and 22.2 mm. The zone for the upper intermolar I width of an average boy of 6 years is from 25.4 to 27.6 mm. The zone for the upper intermolar II width of an average girl of 7 years is from 26.3 to 28.6 mm. By referring to the twenty-fifth and seventy-fifth percentiles this zone may be readily determined for any dimension and age for either sex.

In looking at the minimal and maximal readings for each group it is interesting to note the difference between the child with the smallest dimension and

*For experimental evidence showing that the bigonial diameter is more reliably measured on the roentgenogram than directly on the child, see Potter, J. W., and Meredith, H. V., Comparison of Two Methods of Obtaining Biparietal and Bigonial Measurements, J. D. Res. 27: 459-466, 1948.

†The bizygomatic diameter could not be measured on the roentgenograms due to the overlapping of the shadows of the mastoid, zygoma, and other structures.

the one with the largest. For instance, for the intermolar I width of males of 7 years the range is from 22.4 to 35.5 mm., or a span of 13.1 mm. On the other hand, for the intercuspid width of girls of 4 years of age the extreme values are 19.0 and 24.0 mm., giving a range of 5.0 mm.

TABLE I. MAXILLARY DENTAL ARCH WIDTHS AT THE AGES OF 4 TO 7 YEARS

AGE	NUMBER OF CASES	MEAN	MINIMUM	PERCENTILES 25	50	75	MAXIMUM
			Intercuspid: Males				
4	30	22.1	18.6	20.8	22.1	23.5	26.1
5	42	22.7	18.7	21.9	22.7	23.4	29.7
6	38	23.3	19.8	22.7	23.3	23.9	27.0
7	34	24.4	20.4	23.0	24.1	25.5	32.2
			Intercuspid: Females				
4	31	21.3	19.0	20.2	21.1	22.2	24.0
5	52	21.4	19.2	20.3	21.3	22.3	25.6
6	45	21.8	19.0	20.6	22.0	22.7	25.9
7	38	22.7	19.5	21.7	23.0	23.9	26.9
			Intermolar I: Males				
4	30	25.4	21.0	24.3	25.2	26.9	29.7
5	41	26.2	21.8	25.2	25.9	26.9	34.3
6	39	26.7	22.9	25.4	26.8	27.6	31.6
7	34	27.4	22.4	25.7	27.3	28.5	35.5
			Intermolar I: Females				
4	31	23.9	19.4	23.0	23.8	24.8	27.2
5	50	24.4	21.2	23.3	24.1	25.4	28.3
6	46	24.5	21.8	23.1	24.7	25.6	28.1
7	38	24.9	22.2	23.6	24.7	26.0	28.9
			Intermolar II: Males				
4	32	27.6	22.8	25.6	27.5	29.3	31.0
5	36	28.9	23.7	27.9	28.6	29.5	35.8
6	37	29.6	25.3	28.4	29.8	30.8	34.0
7	34	30.3	24.8	28.8	30.3	31.7	36.6
			Intermolar II: Females				
4	28	26.0	22.2	24.9	26.0	27.0	30.5
5	50	26.8	23.3	25.6	26.6	27.6	31.1
6	44	27.1	24.8	25.8	26.9	28.2	31.5
7	37	27.5	24.6	26.3	27.4	28.6	31.4

A comparison of the range of males and females shows that the boys have the greater variability in every subgroup except the intermolar II at 4 years, where they differ by only 0.1 mm. The two sexes have close minimal values in all groups but the boys have appreciably larger maximal values in several subgroups. An example here is the intermolar I at 7 years, where there is only 0.2 mm. difference at the lower extreme but 6.6 mm. at the upper extreme.

The range for any age-sex-arch width group may easily be determined from the table.

GROWTH IN MAXILLARY ARCH WIDTH DURING THE BIENNIUM 5 TO 7 YEARS[2, 3]

Table II contains an analysis of the change in deciduous arch widths during the period from 5 to 7 years.

Central Tendency Findings.—The increment means for the intercuspid measurement will be seen to exceed those for both intermolar dimensions. The

mean increments for the intermolar widths of males and females are approximately alike. On the whole the median values (fiftieth percentiles) are smaller than the mean values.

Variability Findings.—In determining the zone within which the changes for the child considered average will fall, the twenty-fifth and seventy-fifth percentiles are used. This includes the central 50 per cent of the subjects. Thus, referring to Table II it is seen that the average boy will show an increase of 0.9 to 2.2 mm. for the intercuspid width. For the average girl an increase between 0.3 and 1.2 mm. for the intermolar II width may be expected, and so forth.

TABLE II. CHANGE IN MAXILLARY ARCH WIDTH FROM 5 TO 7 YEARS

SEX	NUMBER OF CASES	MEAN	MINIMUM	PERCENTILES 25	50	75	MAXIMUM
			Intercuspid				
Male	27	1.5	0.2	0.9	1.5	2.2	3.0
Female	33	1.8	–1.3	0.7	1.4	2.1	3.6
			Intermolar I				
Male	29	1.0	–0.2	0.5	0.9	1.3	1.7
Female	32	1.1	–1.0	0.2	0.7	1.2	2.5
			Intermolar II				
Male	23	1.1	–0.3	0.6	1.0	1.4	2.2
Female	33	1.1	–0.5	0.3	0.8	1.2	2.4

Girls have a greater variance than boys (as shown by the difference between their smallest and largest values) for each of the three dimensions. Compared with boys, girls also have the minimal and maximal values for each dimension. The intercuspid range for boys is the only one in the entire group which does not have a negative minimal change, whereas the intercuspid minimal value for girls of –1.3 is the largest negative change in any group. The range for girls becomes smaller from intercuspid through intermolar II; but while the intercuspid range of males is also the largest, the intermolar I group has the smallest range.

ABSOLUTE MANDIBULAR ARCH WIDTHS AT THE AGE OF 5 YEARS

The mean and median values at the age of 5 years in Table III show that the typical boy has a broader mandibular deciduous arch than the typical girl for each of the three interlingual widths studied.

TABLE III. MANDIBULAR DENTAL ARCH WIDTHS AT THE AGE OF 5 YEARS

SEX	NUMBER OF CASES	MEAN	MINIMUM	PERCENTILES 25	50	75	MAXIMUM
			Intercuspid				
Male	32	17.5	14.7	16.3	17.5	18.6	20.1
Female	40	16.6	14.2	15.8	16.7	17.4	18.8
			Intermolar I				
Male	31	23.0	18.6	22.3	23.0	24.2	25.5
Female	34	21.1	18.0	20.5	21.1	21.9	24.2
			Intermolar II				
Male	26	26.3	22.2	25.2	26.7	27.5	29.7
Female	26	24.9	21.2	23.3	24.7	26.5	28.1

The variation that may be anticipated for the intercuspid dimension on one-half of boys is from 16.3 to 18.6 mm.; that for the intermolar I width of the average girl is from 20.5 to 21.9 mm., and so on. Using the twenty-fifth and seventy-fifth percentiles it is seen that the average boy has a greater zone for intercuspid and intermolar I dimensions, but the average girl has a greater span for the intermolar II width.

The boy's range is approximately 0.7 mm. greater for each of the three dimensions. For instance, in the intermolar I group the range for boys is 6.9 mm.; for girls it is 6.2 mm. The range for boys and girls increased from the intercuspid to the intermolar II groups.

ABSOLUTE BIGONIAL AND BIZYGOMATIC DIMENSIONS AT THE AGE OF 5 YEARS

Table IV shows that the bigonial diameter for the typical 5-year-old boy is 80.3 mm., or 1.9 mm. larger than that for the typical girl of the same age.

The bizygomatic diameter for the typical boy of 5 years is 113.0 mm.; for the typical girl it is 109.0 mm.

TABLE IV. FACE WIDTHS AT THE AGE OF 5 YEARS

SEX	NUMBER OF CASES	MEAN	MINIMUM	PERCENTILES 25	50	75	MAXIMUM
			Bigonial				
Male	45	80.3	70.5	77.1	80.2	83.5	89.3
Female	41	78.4	73.1	76.0	78.6	80.2	86.0
			Bizygomatic				
Male	42	113.0	105.5	110.0	113.0	116.0	122.0
Female	53	109.0	98.0	106.5	109.5	111.5	117.5

The average boy of 5 years shows greater variability for the bigonial and bizygomatic diameters than the average 5-year-old girl. The zone of the central 50 per cent in bigonial diameter is from 77.1 to 83.5 mm., or a variation of 6.4 mm., in boys, and from 76.0 to 80.2 mm., or a span 4.2 mm., in girls. For the bizygomatic width the zone for boys is from 110.0 mm. to 116.0 mm., which is 1.0 mm. larger than the zone for girls (the limits of which are 106.5 and 111.5 mm.).

The bigonial range of boys is 18.8 mm. compared with 12.9 mm. for girls. However, the girls, with a span of 19.5 mm., have a 3.0 mm. greater bizygomatic variation than the boys.

CORRELATION OF FACE AND ARCH WIDTHS AT THE AGE OF 5 YEARS

No clinically or practically significant relation exists between the bigonial dimension and the three interlingual widths of the mandibular arch at the age of 5 years. Nor was a definite relationship found between the bizygomatic dimension and the similar interlingual widths of the maxillary arch at the age of 5 years.

The maxillary intercuspid widths for boys and girls have larger coefficients of correlation than the same mandibular measurements. The intermolar I and II widths of both arches and for both sexes (with one exception) have larger coefficients of correlation than the intercuspid widths. The coefficient of corre-

lation for the mandibular intermolar II width for boys (r = 0.58) is statistically significant, as are the coefficients for the maxillary intermolar I and II widths for girls.

TABLE V. COEFFICIENTS OF CORRELATION OF FACE WITH ARCH WIDTHS AT THE AGE OF 5 YEARS

SEX	NO.	INTERCUSPID	NO.	INTERMOLAR I	NO.	INTERMOLAR II
	Bigonial Diameter With Widths of the Mandibular Dental Arch					
Male	31	0.02	30	−0.06	26	0.58
Female	39	0.32	34	0.43	26	0.38
	Bizygomatic Diameter With Widths of the Maxillary Dental Arch					
Male	42	0.22	41	0.36	36	0.37
Female	52	0.33	50	0.42	50	0.54

SUMMARY

The data for this investigation were obtained from one hundred thirty white children (67 males, 63 females) who are enrolled in the Facial Growth Study being conducted at the University of Iowa. Approximately 95 per cent of the parents were of northwest European ancestry, and resided in or near Iowa City. Socioeconomically they were above average. The records of 86 per cent of the children were utilized at more than one age. Of this group 32 per cent appear in the study at two ages, 38 per cent at three ages, and 16 per cent at four ages.

Materials used included casts of the deciduous dental arches for determining arch widths, standardized posteroanterior cephalometric x-rays for obtaining bigonial diameter, and direct measurements of bizygomatic diameter. All were provided by the files of the Study.

Three widths of the upper and lower deciduous dental arches (intercuspid, intermolar I, and intermolar II) were employed. Central tendency and variability findings for these three interlingual widths were tabulated for boys and girls for the maxillary deciduous arch from 4 to 7 years and for the mandibular deciduous arch at the age of 5 years.

Growth in arch width of the maxillary deciduous arch during the period from 5 to 7 years was determined by the three interlingual dimensions and arranged to show central tendency and variability values. The bigonial and bizygomatic diameters of boys and girls of 5 years of age were analyzed for central tendency and variability. Face and arch widths of boys and girls at the age of 5 years were studied for degree of relationship.

Major findings are:

1. The typical boy has a wider maxillary deciduous dental arch in the cuspid and molar areas than the typical girl at the ages of 4 to 7 years.

2. The mandibular deciduous dental arch of the typical boy is wider in the cuspid and molar regions than that of the typical girl at the age of 5 years.

3. The means for boys and girls indicate a steady increase in maxillary deciduous dental arch widths from 4 to 7 years. The increase in the means is greater for boys than for girls over the three-year period.

4. Measurements on the same children at 5 and 7 years show that during this biennium the typical child increases about 1.5 mm. in maxillary intercuspid width and about 1.0 mm. in maxillary width between the first and second decidu-

ous molars. The increase in both intermolar dimensions is almost identical for boys and girls, but the girls show a 20 per cent greater increment in intercuspid width. There is a decrease in maxillary deciduous dental arch width in a few children of both sexes from the ages of 5 to 7 years.

5. The bigonial and bizygomatic dimensions for the typical boy are larger than those for the typical girl at the age of 5 years. No clinically useful relationship exists between the bigonial and bizygomatic diameters and their respective deciduous dental arch widths for boys or girls at the age of 5 years.

I wish to express my deep appreciation to Dr. Howard V. Meredith for his most helpful direction of this study, to Dr. L. Bodine Higley and Mrs. Helen B. Bradley for their generous assistance, and to all who have participated in the Facial Growth Study of the State University of Iowa.

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MEDICAL CENTER.

Reports

REPORT OF THE COMMITTEE ON EDUCATION, AMERICAN ASSOCIATION OF ORTHODONTISTS, 1951

BECAUSE the last two annual reports of your Committee on Education have already been published in the AMERICAN JOURNAL OF ORTHODONTICS it does not seem necessary to review the work of the first two years except to recall that, following our meeting in New York in 1949, when your present committee was elected, it subsequently joined the Committee on Instruction in Orthodontics of the American Association of Dental Schools. Both committees had been assigned the same task, and it seemed wise to combine their efforts.

The final report of the work of the two groups was presented at the annual meeting of the American Association of Dental Schools, at French Lick, Ind., on March 19, 1951, and Dr. Hemley, chairman of the Schools Association committee, has made available a copy of that report for presentation to you.

UNDERGRADUATE INSTRUCTION IN ORTHODONTICS

Report to the American Association of Dental Schools by the
Committee on Instruction in Orthodontics
March 19, 1951

The Committee on Orthodontics was appointed in 1948 by the Committee on Teaching of the American Association of Dental Schools. It made a tentative report to the Association in 1949, which summarized undergraduate orthodontic teaching in the dental schools of the United States and Canada and set forth seven conclusions and recommendations.

(An abstract of the report and the papers and discussions relative to it were published in the proceedings of the American Association of Dental Schools, 1949, pages 88-109.)

The Committee recommended that orthodontics should be regarded as an integral part of undergraduate dental training and that it should occupy a position as a clinical department. The Committee recognized, however, that serious problems had to be overcome in order to make the recommendations effective. One of these problems was how to include in the undergraduate dental curriculum a considerable body of material that is fundamental to orthodontics and is at the same time basic to other aspects of general dentistry.

The point of view of the Committee was:

". . . (1) that without utilizing and, in fact, without pointing up this basic material, clinical orthodontics cannot be made an effective and useful department of undergraduate dentistry, (2) that the orthodontic staff cannot handle both the basic and the clinical divisions of its requirements without a lengthening of the curriculum, and (3) that the basic material fundamental

Presented at the meeting of the American Association of Orthodontists, Louisville, Ky., April 23-26, 1951.

to the teaching of orthodontics is so important to the concepts of general dentistry that serious thought should be given to the re-orientation and re-integration of biologic fundamentals, with the result that all departments of dentistry would benefit without the addition of time to the curriculum."

The Committee therefore requested opportunity to demonstrate the teaching of material that is fundamental to orthodontics and to indicate the importance of these concepts to general dentistry as well. Two general sessions of the annual meeting of the Association in 1950 were granted to the Committee for this purpose. At that time, through the generous efforts of Dr. Allan G. Brodie, five model undergraduate lectures were presented to this association to demonstrate this interrelationship under the headings: (1) Applications to Dental Anatomy; (2) Mechanisms of Adjustment to Wear and Accident; (3) Anatomical and Physiological Principles; (4) Applications of Anatomical and Physiological Principles to Clinical Fields of Dentistry; and (5) Growth of the Jaws and Eruption of the Teeth.

Those who witnessed the five lecture demonstrations which he arranged were agreed that the subject matter presented should be considered basic to all departments rather than exclusively important to orthodontics and that correlations between basic sciences and clinical subjects which have had to be worked out in orthodontic teaching can be used, in fact must be used, to strengthen this relationship in all other departments.

After this sort of demonstration at last year's session, it remained for this Committee to present its conclusions and recommendations. It became necessary first, however, to decide whether or not, theoretically at least, it favored the extension of the undergraduate course in dentistry to include the treatment of patients having malocclusion.

For twenty-five years a serious effort has been made, first in a few, and later in most of the schools, particularly after the publication of the curriculum survey report in 1935, to correlate teaching in all departments with the biologic approach. After a slow process of evolution, discouragingly slow at times, most schools now recognize the importance of this correlation and succeed with it to such an extent that the poorest job done now is far better than the best that was being done fifteen or twenty years ago.

During all these years orthodontics has continued to be the field in which the relationship between clinical dentistry and the biologic sciences can be demonstrated most vividly and convincingly to the student. This is true because most of these relationships are seen better there than in the other clinical fields of dentistry. And yet this most natural of all means by which the biologic approach can be effectively indicated has been missed by all but a few schools.

It is therefore the considered opinion of this Committee that the expansion of clinical orthodontics provides an excellent opportunity to tie clinical dentistry more securely into its biologic background.

It is agreed that one of our greatest problems is that of discovering men trained both in basic and clinical fields who possess the ability to make application from the former to the latter. However, it is the opinion of this

Committee that, once objectives are determined, teacher preparation will be stimulated to meet them and the personnel shortage will be solved. Personnel is already available in several of the schools where clinical programs have been in operation.

The Committee recommends:

That orthodontics should occupy a definite position as a clinical department in the dental course. As such its suggested objectives are to train the student as follows:

a. To anticipate and detect malocclusion.
b. To take steps to prevent or intercept malocclusion where possible.
c. To treat simple cases or the simple immediate problems of complex cases.
d. To use this knowledge as an adjunct to procedures in all other phases of dental practice.
e. To know what cases to avoid and refer to more experienced men in the field.

It is estimated that approximately 300 hours would be required to implement this clinical program.

Since the Committee's survey showed a lack of time in many schools for the adequate teaching of undergraduate orthodontics, it is apparent that some means must be found to provide the time necessary to carry out the program recommended. The Committee makes the following recommendations for obtaining this time:

1. As indicated in previous reports by this Committee, it is apparent that the maintenance of the functions of occlusion should form the basis of all dental teaching. By study of occlusion in this connection, we mean the embryological, fetal, and prenatal development of the teeth, jaws, and face; environmental factors which govern them throughout life and which may under certain circumstances lead to deformity and disease. It must include the detailed analysis of the normal functioning of each individual part and the various manners in which each such function may become deranged. The Committee wishes to emphasize the fact that where this type of teaching is embraced, the fundamental concepts of all fields of clinical dentistry are of a more scientific nature.

The Committee, therefore, recommends:

That this material now be considered basic and that all clinical departments share in the responsibility of planning its presentation and in making available the necessary time in the curriculum. The Committee suggests that each school might well appoint a committee with representatives from all departments to determine:

a. Content of such a course or courses
b. Its placement in the curriculum
c. Personnel and facilities for the presentation of this material

2. As a means of obtaining additional time for the teaching of undergraduate orthodontics the Committee also recommends that the total curriculum be re-evaluated to make sure that it is consistent with sound teaching principles and efficient teaching methods and that it excludes repetitive, out-of-date, and other nonessential material. In those schools where such critical re-evaluation has been made, its effectiveness in the saving of time has been conclusively demonstrated.

The Committee suggests that the time seems ripe for a reappraisal of the dental curriculum with a view to breaking down its present highly departmentalized organization and a substitution, therefore, of a course of instruction aimed at the rendering of a complete service to the patient throughout life. This will require the bringing together of all biological knowledge into a logical sequence and its application to the several types of clinical service.

Respectfully submitted by the
Committee on Instruction in Orthodontics

ALLAN G. BRODIE, University of Illinois,
G. VERNON FISK, University of Toronto,
SAMUEL HEMLEY, New York University, Chairman, 1950-1951,
LESTER B. HIGLEY, State University of Iowa,
GEORGE R. MOORE, University of Michigan, Chairman, 1948-1950,
THOMAS D. SPEIDEL, University of Minnesota,
WENDELL L. WYLIE, University of Washington,
CHARLES WALDO, Harvard University.

This report is tendered to the Board of Directors of the American Association of Orthodontists as the report of its Committee on Education for 1951.

Respectfully submitted,
L. B. HIGLEY,
T. D. SPEIDEL,
A. G. BRODIE, Chairman.

REPORT OF THE NOMENCLATURE COMMITTEE, AMERICAN ASSOCIATION OF ORTHODONTISTS, 1951

YOUR nomenclature committee, composed of Dr. George B. Crozat, Kyrle Preis, and Frank S. Cartwright (chairman), has tried to further the interests of dentistry by restudying many dental terms and phrases. It is a long, arduous task. The results are slow, yet each year a few terms have been presented to the Society for approval. In our work we have been fortunate in having the wise counsel of Dr. George B. Denton, philologist for the American Dental Association. In his splendid article, "Past Efforts to Improve Dental Nomenclature," appearing in the March, 1951, issue of *The Journal of the American Dental Association,* he gives six reasons why so little success has been achieved by nomenclature committees. We quote:

"A retrospect of the efforts of organized dentistry, and especially those of the National and of the American Association to improve dental nomenclature must reveal that, despite much useful work, the results have not been altogether satisfactory, neither to the men who faithfully served on the committees nor to the profession who, for the most part, have showed only perfunctory interest. It might be proper to inquire why no greater success has been achieved.

"1. Perhaps the most potent cause is the inherent difficulty of the problem. It has been urged that other fields of knowledge have been eminently successful in solving the difficulties of terminology. It is doubtful, however, whether in comparable matters the other disciplines have so far outstripped dentistry in this regard. The pure sciences, notably biology and chemistry, which have been most successful in developing an adequate nomenclature, have been concerned exclusively with a species type of terminology. The nomenclature problem of the applied sciences (including medicine and dentistry) has been of a different sort, since they are mostly concerned with purposes, causes, processes and procedures. These are not readily classified. Superimposed upon this conceptual complication are numerous tendencies and deficiencies of language to be accommodated or to be compensated for. Logic and reason will not remove all the difficulties.

"2. Lack of the special training and experience necessary upon the part of the workers has frequently existed. The volunteer worker cannot be expected to be a profound dental student and linguist.

"3. There has not always been sufficient continuity of personnel. Only where some enthusiast has led the study over a long period (as in the cases of Black, Cuilford and Anthony) has any degree of progress been achieved.

"4. The geographic separation of the members of committees has almost always made cooperation and collaboration difficult.

Presented at the meeting of the American Association of Orthodontists, Louisville, Ky., April 23-26, 1951.

"5. Very little moral support from the profession and from dental teachers and journalists has been accorded the best advice of nomenclature committees.

"6. Little financial support has been given to provide adequate study of the problems and to publicize and disseminate the results."

Your Committee wishes to express that it is in accord with Dr. Denton's views and at this time has no definitions to present. At present no dental dictionary is in print or on the market. In our report of 1950 we strongly urged our Society to join hands with all other specialists to better evolve a dictionary that will do honor to dentistry and save posterity from present-day dental nomenclature confusion. We again urge you to action!

Respectfully submitted,
GEORGE B. CROZAT,
KYRLE PREIS,
FRANK S. CARTWRIGHT, Chairman.

Department of Orthodontic Abstracts and Reviews

Edited by
DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Development and Behaviour of Children: By Norman B. Capon. *Brit. M. J.*, April 15, 1950.

The outstanding characteristic of life during its embryonic, fetal, and childhood phases is the phenomenon of growth in mass (or weight) and in dimensions. It is accompanied by changes in the relative proportions of the component parts of the individual; by the development and elaboration of functions or skills consequent upon cellular specialization; and by a changing pattern of behavior or reaction to internal and environmental conditions. The mode and degree of this evolution during childhood throw light upon the state of well-being of the individual, and its study is a source of great interest to all who deal with children. But perhaps its special significance lies in the promise that it may carry for the future, when maturity succeeds to immaturity.

Most children are born in a state of full health; but there are many that subsequently deteriorate through the successive grades of "average" health to subnormal health and, later, to disease.

We must train ourselves to be sensitive to the positive attributes which characterize a healthy child. Some of these are physical—his color, his posture, his delight in bodily exercise; some are intellectual—his zest to learn and his adventurous mind; some are emotional—his affection, his response to leadership, his loyalty. The differences between individual children are great and I am not suggesting that there is an accepted list of attributes and virtues which each child must satisfy before he can be called truly healthy. But it is only by making a search for these and other evidences of health that the examiner can maintain his own diagnostic standards at a sufficiently high level; and in doing so he will find that he places increasing reliance upon the child's pattern of behavior as a complete individual.

A doctor may understand that the dissimilarities between a child and a grown man are not to be measured merely by differences in weight and in relative size of parts. Whether the individual be sick or well, to understand his behavior (using this word in the widest sense, to cover all his reactions to changes within himself and in his environment) as an individual or unit of life is one of our most important aims.

To study the development of a child it is necessary to observe him through the successive phases of his life and to consider how he reacts to the conditions, normal and abnormal, that prevail, remembering always that the effects of trauma, infection, or other abnormal circumstances may be slow to show themselves. Genetic factors come first, chronologically, in the list; then the influence of intrauterine conditions, including the effects that the mother's health and environmental circumstances may have upon her embryo and fetus. Later comes the act of birth, which must be thought of not only as physical separation of mother and child but also as the culmination of remarkable

changes in fetal anatomy and physiology. Finally, after birth, the child comes directly under the influence, sometimes beneficial, sometimes harmful, of his environment, which includes both physical and human components. And all through these successive phases growth and development are susceptible also to internal endogenous conditions, such as the influence of ductless glands.

Genetic factors are important in determining an individual's future health, but the details of their operation are imperfectly known. It now seems likely that many malformations or disordered states are due to an interplay of genetic and acquired influences, and it may well be that the effects of hereditary mutation are not infrequently simulated by those due to environmental conditions.

During the first six weeks of antenatal life the fertilized ovum, weighing about 0.005 milligram, becomes an embryo of approximately 0.975 gram, which is a multiplication of 195,000 times; it is as if a hen's egg (2 oz.) grew to a mass of 10 tons in the same period and proceeded to become a leviathan of 33,000 tons by the end of the normal (human) antenatal period.

In general it may be said that the harmful effects of trauma, intoxications, infections, and other potentially damaging processes vary not only with the nature of the offending agent and the structure and functions of the tissue mainly attacked, but also with the maturity of that tissue; and experimental (animal) embryology has provided numerous examples of disturbed growth and development caused by such differing stimuli as trauma, irradiation, hormones, lack of vitamins, etc., when these operate during the organogenetic period. In man, chief interest has centered around the possible effects that faults in maternal diet, irradiation of the mother's pelvic organs, and various diseases of the mother may have upon the embryo.

In regard to diet, it would seem reasonable, on general principles, to believe that the embryo is unlikely to suffer by the range of variations in diet ordinarily taken by mothers in civilized countries, and the general conclusions reached at a discussion held by the Nutrition Society (1942) supported this view. Yet various surveys of nutrition in pregnancy which have taken place during recent years have suggested that the stillbirth and prematurity rates can be reduced by improving the quantity of the mothers' diets. In all probability the beneficial effects of a high-quality maternal diet operate upon the child in the later part of antenatal life rather than during the early weeks when organogenesis is occurring. But there is a possibility that specific dietetic deficiency may be harmful to embryonic growth and development in man; and in this connection Warkany (1947) describes the deformities that can be produced experimentally in animals with diets deficient in copper, iodine, and vitamins A and B.

In regard to the possible effect upon the human embryo of irradiation applied to the mother's pelvis, there is not yet enough evidence to reach a definite conclusion. The contribution by Goldstein and Murphy (1929) called attention to the danger.

Although the etiology of congenital malformations has been studied for centuries, it was not until Gregg's paper in 1941 that important evidence was published incriminating maternal disease (rubella) during the early weeks of pregnancy. It is now accepted that rubella and possibly other maternal infections may disorder embryonic growth, but their mode of action and the frequency of their operation are not known.

There is as yet no clear evidence incriminating the common infectious diseases, apart from rubella, as a cause of congenital malformations; Fox, Krumbiegel, and Teresi (1948) made a recent report on this subject in regard to measles, mumps, and chicken pox.

Apart from untreated syphilis, it is unusual for disease of the mother to be transmitted through the placenta to her child, and the placenta itself is seldom invaded either by infection, such as tuberculosis, or by growth, though Eardley Holland (1949) reported an interesting example of malignant melanoma which was transmitted by the mother to her fetus.

Attention has been called in recent years to toxoplasmosis in fetal life, but the frequency of this infection is still unknown. The effect of the protozoon is to cause a low-grade inflammation in the fetal tissues, especially in the nervous system, and its clinical manifestations in the early months after birth are numerous, the most frequent being meningoencephalomyelitis, microphthalmus, bilateral chorioetinitis in the central area of the fundus, and hydrocephalus or microcephalus. The child is frequently retarded mentally and is liable to have convulsions; intracranial calcification may be seen radiographically.

Whether Toxicoplasma infection is frequent or not, these studies have revealed another possible cause of fetal disease and have suggested that others await discovery. They have also called attention to the damaging effect upon growth—for example, microphthalmus—that may be caused by pathologic processes operating upon the fetus subsequent to the organogenetic period.

Mystery still surrounds those cases of fetal deformity in which the so-called amniotic bands (Simonart's ligaments) are found. A fibrous cord may completely encircle a finger, the wrist, or any part of a limb; or sometimes one end of the band is attached to the child's skin and the other end is free or is attached to the inner surface of the fetal membranes.

It is rather surprising that disorders of fetal growth ascribable to abnormalities of the mother's hormonal mechanism appear to be infrequent. One example may be mentioned, the relatively rapid growth of the fetus of a diabetic mother, probably as a result of her excessive pituitary secretion. The child may reach the average birth weight of a mature baby by the thirty-sixth week of pregnancy and thus there may be obstetrical difficulty at birth. It is interesting also to note that the birth weights of infants born to mothers who subsequently develop diabetes mellitus are greater than the average normal, and the total fetal mortality rate in such pregnancies is greater than in nondiabetic pregnancies.

Deformity of the child may be caused by faulty position in utero. Asymmetry of the head, deformity due to pressure of the head downward upon the thorax, torticollis, and pressure atrophy of the skin are examples.

At one time the accepted opinion was pessimistic, and it was thought that children who had been born prematurely were often of poor physical and mental status; in recent years there has been a tendency to take a more optimistic—perhaps too optimistic—view.

Prognosis varies with the cause of prematurity, the type of labor and quality of the obstetrical service, the facilities available for the medical and nursing care of the infant, and the economic and intelligence status of the parents.

My own experience has convinced me that the immature baby's environmental conditions during the first twelve months after birth play a very great part in determining his future, and he is indeed fortunate if by the accident of birth he is born into a home where the parents are intelligent, well housed, and economically capable of providing the best possible conditions for him.

Each person, even in childhood, has certain qualities or attributes—physical, intellectual, and emotional—which can for convenience be grouped together as his individual or constitutional pattern and which we must try to recognize and accept as a background to his growth and development. These attributes are not always measurable, and sometimes they are difficult even to describe satisfactorily. For instance, there are children who are tall and lanky, others who are sturdy and squat; there are children of high intelligence

and others who show an excess of stupidity; there are children who prefer to be solitary and others who are sociable. Some children are by nature difficult to manage, and their parents deserve pity rather than criticism.

In attempting to assess the physical status of an individual we may expect considerable variation according to sex, race, family predisposition, environmental conditions, habits of life, etc. The criteria usually adopted are based upon: (1) certain biometrical tests in which physical characteristics such as weight, height, hemoglobin percentage, and visual acuity are measured and compared with standards based upon the examination of large groups of supposedly healthy subjects; (2) observation of the neuromuscular (or, as some would say, psychomotor) attainments of the child at successive ages, assuming that there is no detectable mental or physical disease to handicap progress and performance.

In individual cases, and sometimes in relatively small groups of children, other tests have been applied, usually for testing some specific aspect of physical condition, such as ascorbic acid blood levels.

In regard to biometrical tests, the measurement of weight and height is, of course, simple to record, and the literature contains many reports based upon large-scale investigations which provide standards for comparative purposes. Unless one can assess the child's constitutional type, weight and height alone may have little meaning; and, in any case, comparison should be made with an "optimum" rather than an average standard. Their significance for the individual child is, of course, greater if the readings are recorded at intervals of time, to give some indication of progressive changes with age and the varying conditions of life.

Wetzel's (1941) studies went a stage further in the attempt to record and measure physical status in childhood. In his "grid" system he claimed that by plotting height, weight, and age on a special chart or "grid" it was possible to separate the individual effects of various physical attributes such as physique (or body build), developmental level, and nutritional grade, and from these to reconstruct a graphic picture of physical progress; and he claimed that by the use of this method it was possible to recognize the onset of malnutrition before any signs could be detected by the ordinary methods of clinical medicine (Coleman, 1949). A point of particular importance was Wetzel's (1943) emphasis upon the use of a method which aimed at showing whether a particular child was keeping up to the best progress of which he was capable, rather than comparing him with some other child taken as a standard.

In regard to neuromuscular attainments, the work of Gesell and others who have made special studies of the attainment and progress of infants and children is well known. Above everything, it has illuminated the details of the integration which has long been known to exist between the nervous system and all other systems, and has emphasized a point of view that is fundamental to both preventive and curative pediatrics because it takes count not only of specific localized competencies and skills but also of the attainments and behavior of the whole child as a separate unique individual.

Specific dietetic deficiencies, such as the avitaminoses, may be very harmful to normal growth and development, as in rickets and scurvy. Adverse hygienic conditions, such as lack of sunlight and fresh aid, uncleanliness, bad housing conditions, lack of adequate rest and exercise, may affect growth and certainly interfere with the development of a proper sense of values in regard to habits of life and standards of living. The diseases which disturb growth and development are very numerous. Gardiner-Hill (1937) called attention to the influence and interaction of four groups of possible factors—nutritional, infective, endocrine, and hereditary—and since that time there

have been many advances in our understanding of these problems, especially in regard to endocrine disturbances.

It is now generally agreed that insufficient attention has been given to the emotional development of children. If they are to be healthy and happy they must certainly have healthy bodies and minds; but in addition their nervous systems must be reasonably stable and capable of suitable adjustment to environmental variations. Maladjustment, which often leads to unhappiness, frustration, and sometimes to delinquency, may be related not only to physical disorder and to intellectual retardation and abnormality but also to emotional disturbances.

It requires no special knowledge of psychology to appreciate that the primary instincts of nutrition and self-preservation are powerful motive forces in children. The desire for food, stimulated by hunger, and the search for protection against environmental stresses and dangers are fundamentals in life; and the infant, like all young animals, turns to his parents for these services, for he has not yet learned to seek actively for food that is not ready to hand, nor has experience taught him the adult's range of adaptation to changing environmental conditions.

For full emotional health and development in infancy, parental affection and protection are necessary, and the child's needs for security and for the demonstration of affection must be supplied. Is it not true that mature men and women usually live fuller, healthier, and happier lives if they enjoy a sense of relative security—for instance, in every respect of livelihood—and when they have someone with whom they can share affection? And if this is true of adults, is it not still more true of children?

The best guidance for children, with their faculty for imitativeness and habit formation, is affection blended with the stimulus of good example.

No less harmful than excessive protection is the failure by the parents to exercise reasonable discipline. In practice this usually means that a child should not be expected to make decisions which are beyond his powers of reasoning; such decisions must be made by the parents, and the child must obey. Authoritative control of this sort needs gradual modification as the child grows older.

The general conclusions that may be drawn from a study of the etiology of functional nervous disorder in childhood point to the immense part played by a normal home life in the evolution of full health. It is from his human contacts, especially in the home, that a child derives emotional satisfaction and, with suitable guidance, develops self-reliance, unselfishness, and a sense of moral and social values. With this foundation his responses and reactions to the broadening experience of life that comes during later childhood and puberty will be encouraged to take shape in a spiritual sense. But if he is denied these advantages he is in danger of growing up under the handicap of an unstable nervous system, a victim to indecision and frustration because his inherent potentialities have not been able to come to fulfillment.

Two tests of health in children stand out preeminently and form the basic criteria of a child's health status; the first is his growth and development; the second is his behavior as a separate, though immature, member of society. The various methods of clinical examination, which are designed to provide information about the physical and mental condition of the child, are essential techniques toward this end, but they must be regarded as the preliminaries to a comprehensive survey of the child's conduct or behavior as an integral unit of his society.

I submit that the future offers to the medical profession still greater opportunities of service than it has enjoyed in the past—in both the curative and the preventive field—and that doctors engaged in pediatrics are likely to be

especially fortunate in this respect, for their influence bears upon life during its formative period. To them are granted signal opportunities of helping children to grow up to manhood in such a way as to conform with Lord Morley's dictum that the great business of life is to be, to do, to do without, and to depart.

Food Acids and Caries. Editorial. *J. A. M. A.* **145**: 321-322, Feb. 3, 1951.

The concept that acid erosion is the fundamental cause of dental caries was advanced more than half a century ago. Further experimental evidence supporting this hypothesis was recently presented. From a microbiologic point of view, the demonstration of the high acidophilus count in carious mouths was of great significance, since it revealed a mechanism for the production of acid food residues. Another important observation was that in a group of children the only significant difference between the composition of the saliva of caries-free and of carious mouths was the strikingly higher buffer capacity of the former. In line with this finding was the demonstration that removal of the salivary glands in rats resulted in severe hypertrophic gingivitis and caries on the exposed surfaces of the molars in less than three weeks.

Improved techniques for experimental study of caries have been introduced recently. The Syrian hamster has been used widely as an experimental animal, since it was shown to have a tooth structure more like that of human teeth than that of other rodents. Ordinarily the common laboratory albino rat is not readily susceptible to caries, the cotton rat being more useful in studies of this disease. However, if the mothers of the young albino rats are restricted to purified caries-producing rations during pregnancy and lactation, their progeny become as susceptible to tooth decay as the cotton rat. That contact of food with the tooth surface is a prerequisite for caries production seems clear from an investigation in which a caries-producing ration was fed to young rats through a stomach tube. While lesions developed in all of the control group eating the diet, the rats receiving the food through the tube were not affected.

"Soft" drinks, which usually contain a considerable concentration of organic acid in addition to flavoring, sugar, and carbon dioxide, and acid-sugar combinations that stimulate "soft" drinks, produce etching of the enamel and dentine of the teeth of laboratory rats, hamsters, and dogs. Apparently the acid attack is a function of the titratable acidity of the beverage rather than the pH, while the buffering action of the saliva serves to oppose the erosive action. Acid fruit juices have been recently implicated, and the citrate ion seems particularly prone to produce dental lesions. In one study, apple, grape, pineapple, orange, and grapefruit juices produced pronounced erosion of the lower molars in the albino rat while tomato and prune juices had a much milder action. A recent investigation of Polynesian fruits, grapefruit, Java plum, mango, and pineapple, confirmed the erosive action of acid fruit juices on dental enamel, but when an equivalent amount of the fruit itself was consumed there was much less etching of the tooth substance.

The role of nutrition in the etiology of dental caries has received considerable attention, and vitamins and minerals have been regarded as factors specially involved in dental health. Although there are doubtless nutritional and metabolic factors favoring the development and integrity of the teeth, the presence of acidity, either preformed in food touching the surface of the teeth or developed by bacterial degradation of food residues in the crevices around the teeth, appears to be a prominent factor in the erosion of the enamel and dentine.

News and Notes

The 1952 Meeting of the American Association of Orthodontists

The 1952 meeting of the American Association of Orthodontists will be held at the Jefferson Hotel, St. Louis, Mo., April 21 to April 24.

The chairman of the Local Arrangements Committee is Leo M. Shanley, 7800 Maryland Ave. The following local committees have been named to make the arrangements for the meeting:

Local Arrangements

Leo M. Shanley, Chairman	7800 Maryland Ave.	St. Louis, Mo.
E. V. Holestine, Treasurer	8015 Maryland Ave.	St. Louis, Mo.
Otto W. Brandhorst	4952 Maryland Ave.	St. Louis, Mo.
George H. Herbert	7002 Pershing Ave.	St. Louis, Mo.
Benno E. Lischer	313 N. Rock Hill Road	Webster Groves, Mo.
Albert C. Mogler	462 N. Taylor Ave.	St. Louis, Mo.
H. C. Pollock	8015 Maryland Ave.	St. Louis, Mo.
Frank C. Rodgers	Missouri Theatre Bldg.	St. Louis, Mo.
Henry F. Westhoff	Missouri Theatre Bldg.	St. Louis, Mo.
Joseph H. Williams	3722 Washington Blvd.	St. Louis, Mo.

Stag Dinner

Joseph H. Williams, Chairman	3722 Washington Blvd.	St. Louis, Mo.
Robert E. Bedell	1504 S. Grand Ave.	St. Louis, Mo.
Carl L. Rister	University Club Bldg.	St. Louis, Mo.
George Herbert	7002 Pershing Ave.	St. Louis, Mo.

Ladies' Entertainment

Earl C. Bean, Chairman	120 N. Forsythe Blvd.	St. Louis, Mo.

Co-Chairmen

Mrs. B. G. deVries		
Mrs. H. C. Pollock	40 Fair Oaks	St. Louis, Mo.
Mrs. Otto W. Brandhorst	160 S. Gore Ave.	Webster Groves, Mo.
Mrs. Joseph H. Williams	24 S. Gore Ave.	Webster Groves, Mo.
Mrs. Leo M. Shanley	5 Glen Forest	St. Louis, Mo.

Press

H. F. Westhoff, Chairman	Missouri Theatre Bldg.	St. Louis, Mo.
H. C. Pollock	8015 Maryland Ave.	St. Louis, Mo.

Banquet and Luncheons

Virgil A. Kimmey, Chairman	3722 Washington Blvd.	St. Louis, Mo.
Robert E. Hennessy	8013 Maryland Ave.	St. Louis, Mo.
Robert C. Byrne	2602 S. Grand Ave.	St. Louis, Mo.

Clinics

Otto W. Brandhorst, Chairman	4952 Maryland Ave.	St. Louis, Mo.
Virgil A. Kimmey	3722 Washington Blvd.	St. Louis, Mo.
J. E. Rook	6651 Enright Ave.	St. Louis, Mo.

Registration

George Moore, Chairman	Box 8	Ann Arbor, Mich.
John Byrne, Co-Chairman	2602 S. Grand Ave.	St. Louis, Mo.

Commercial Exhibits

Earl E. Shepard, Chairman	4500 Olive St.	St. Louis, Mo.
William S. Brandhorst	4952 Maryland Ave.	St. Louis, Mo.
Fred Fabric	4559 Scott Ave.	St. Louis, Mo.

	Hosts	
Leo B. Lundergan, Chairman	4500 Olive St.	St. Louis, Mo.
Robert M. Courtney	University Club Bldg.	St. Louis, Mo.
Kenneth C. Marshall	35 N. Central	St. Louis, Mo.
Quentin M. Ringenberg	3722 Washington Blvd.	St. Louis, Mo.
	Property	
A. C. Mogler, Chairman	462 N. Taylor	St. Louis, Mo.
Paul E. Spoeneman	16 Hampton Village Plaza	St. Louis, Mo.
E. W. Hodgson	Missouri Theatre Bldg.	St. Louis, Mo.
	Reception	
H. C. Pollock, Chairman	8015 Maryland Ave.	St. Louis, Mo.
Benno Lischer	313 N. Rock Hill Road	Webster Groves, Mo.
Frank C. Rodgers	Missouri Theatre Bldg.	St. Louis, Mo.
Joseph Williams	3722 Washington Blvd.	St. Louis, Mo.
Otto W. Brandhorst	4952 Maryland Ave.	St. Louis, Mo.
	Hotel Reservations	
J. E. Rook, Chairman	6651 Enright	St. Louis, Mo.
H. C. Pollock, Jr.	8015 Maryland Ave.	St. Louis, Mo.
	Information	
George Herbert, Chairman	7002 Pershing Ave.	St. Louis, Mo.
Clarence R. Geier	3417 Meramec Ave.	St. Louis, Mo.
Everett W. Bedell	1504 S. Grand	St. Louis, Mo.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Hotel Jefferson, St. Louis, Mo., April 16 to April 20, 1952. Orthodontists who desire to be certified by the Board may obtain application blanks from the Secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Mich. To be considered at the St. Louis meeting, all applications must be filed before March 1, 1952.

Southern Society of Orthodontists

Under the direction of President William H. Lewis, of Petersburg, Va., the Southern Society of Orthodontists met at White Sulphur Springs, W. Va., July 29, 30, 31, and August 1.

This twenty-seventh annual meeting of the Society was dedicated to one of its founders, charter members, and second president, Dr. Jacob Gorman, of New Orleans, La. Dr. Gorman practiced orthodontics in New Orleans since 1907. He received his D.D.S. degree from Columbian University, Washington, D. C., in 1898, and was one of the original students of the Angle School of Orthodontia in St. Louis, Mo., in 1903. Dr. Gorman has been one of the enthusiastic members of the Southern Society of Orthodontists and the American Association of Orthodontists over a long period of years.

The visiting essayists at the meeting were as follows:

George M. Anderson, Baltimore, Md. Information for Parents Regarding Orthodontic Treatment.

Bernard G. deVries, Minneapolis, Minn. The Relationship Between the American Association of Orthodontists and its members.

John R. Thompson, Chicago, Ill. Individual Norm·Concept of Occlusion of the Teeth. I. Morphology. II. Function.

Joseph R. Jarabak, East Chicago, Ill. I. The Treatment of Class I and Class II Malocclusion With a Bite Plane and Cervical Strap. II. The Muscular Dynamics of the Reduction of a Class II Malocclusion.

CLINICS

Progressive—Limited attendance clinics were given by:

William H. Oliver
Andrew F. Jackson
Thad Morrison, Jr.
E. C. Lunsford
H. K. Terry
R. B. Clark

TABLE CLINICS

Orville O. Van Deusen
Amos S. Bumgardner
Leigh C. Fairbank
Stephen Hopkins
Faustin N. Weber
Lieutenant Tom Pryse
Norris C. Leonard

CASE REPORTS

W. A. Buhner, Daytona Beach, Fla.
Joseph R. Jarabak, East Chicago, Ill.
H. D. Jaynes, Atlanta, Ga.
William J. Turbyfill, Asheville, N. C.

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will meet at the Shamrock Hotel in Houston, Texas, Oct. 28 to Oct. 31, 1951.

Central Section of the American Association of Orthodontists

The 1951 meeting of the Central Section of the American Association of Orthodontists will be held Oct. 1 and 2, 1951, at the Lowry Hotel, St. Paul, Minn. The program follows:

MONDAY, OCT. 1, 1951

Morning Session

9:00 Welcome
9:30 Diagnosis and Prognosis of Various Types of Class II, Division 1 Malocclusions. Bercu Fischer, D.D.S., New York, N. Y.
10:30 Organizational Responsibilities of Orthodontists. B. G. deVries, D.D.S., Minneapolis, Minn.
11:30 Business Meeting

Afternoon Session

2:00 Relation of Cleft Palate Surgery to Malocclusion. Wayne B. Slaughter, M.D., Chicago, Ill.
3:00 Variations of the Temporomandibular Joint Associated With Malocclusions. Robert Ricketts, D.D.S., M.S., Chicago, Ill.
4:00 What Does Extraoral Anchorage Accomplish? Beulah Nelson, D.D.S., Oak Park, Ill.
6:15 Social Hour
7:00 Dinner

TUESDAY, OCTOBER 2, 1951

Morning Session

9:00 Guides Used in Deciding to Extract Teeth in Treating Class I Malocclusions. George A. Dinham, D.D.S., Duluth, Minn.
10:00 Some Relations of the Upper Anterior Teeth to the Lower Anterior Teeth as Present in a Group of Acceptable Occlusions. S. R. Steadman, B.S., D.D.S., M.S., St. Paul, Minn.
11:00 Problems in Altering Children's Habitual Activities. Paul C. Benton, M.D., Minneapolis, Minn.
12:15 Luncheon and Election of Officers.

Afternoon Session

1:30-4:00 Table Clinics

Great Lakes Society of Orthodontists

The program for the meeting of the Great Lakes Society of Orthodontists, to be held at the Statler Hotel, Cleveland, Ohio, Nov. 5, 6, and 7, 1951, follows:

MONDAY, NOV. 5, 1951

Morning

8:00– 9:00 Registration. Exhibits.
9:00–10:30 Harry Sicher. Growth of the Jaws and Bone in Relation to Orthodontic Practice.
10:30–12:00 Herbert I. Margolis. Cephalographics in Clinical Orthodontics.

Afternoon

12:15– 1:30 Past president's luncheon.
12:00– 2:00 Exhibits.
2:00– 2:30 Case Reports. Joseph R. Gould.
2:30– 4:00 Bercu Fischer. The Use of Occipital Anchorage in the Treatment of Class II, Division 1 Malocclusion.
4:00– 5:00 Business session.

Evening

6:30– 7:00 President's reception.
7:00–10:00 Society banquet.

TUESDAY, NOV. 6, 1951

Morning

8:00– 9:30 Exhibits.
9:30–10:30 Byron O. Hughes. Genetics and Growth in Relation to Orthodontic Practice.
10:30–12:00 Harry Bull. The Treatment of Class II, Division 1 Malocclusion.

Afternoon

12:00– 2:00 Exhibits.
12:15– 1:30 Society luncheon.
2:00– 2:30 Case Reports. Hunter I. Miller.
2:30– 3:30 Harlow L. Shelan. Objectives in Mixed Dentition Treatment.
3:30– 4:00 Case Reports. Charles S. Adelstein.
4:00– 5:00 Business session.

Evening

7:30–10:00 Table clinics.

WEDNESDAY, NOV. 7, 1951

Morning

8:00– 9:00 Exhibits.
9:00–10:00 George M. Anderson. The Activities That Mark and Make a Profession and the Achievements That Aid It to Meet the Demands of the Day.
10:00–11:00 Robert H. W. Strang. Factors Associated With Successful Orthodontic Treatment.
11:00–12:00 Installation of officers.
Adjournment.

LOUIS BRAUN, Program Chairman.

Northeastern Society of Orthodontists

The next meeting of the Northeastern Society of Orthodontists will be held at the Hotel Warwick, Philadelphia, Pa., on Nov. 12 and 13, 1951.

Pacific Coast Society of Orthodontists

The following are excerpts from the *Bulletin of the Pacific Coast Society of Orthodontists* of June 1, 1951:

The Northern Section meets the second Tuesday of March, June, September, and December.

The Central Section meets the second Tuesday of March, June, September, and December.

The Southern Section meets the second Friday of March, June, September, and December.

NORTHERN SECTION

The Northern Section met in Portland on December 10 and had a very delicious dinner at the Multnomah Hotel. Dinner speeches were very limited; in fact, they consisted of one joke by Harold Noyes, something about a monument to ex-President Hoover down in Palo Alto.

The business meeting was called to order by President Stoller and local affairs were taken care of. It was decided that our next meeting after the Pacific Coast meeting in San Francisco would be in Seattle on the Monday before the Pacific Coast Dental Conference meeting on June 25.

In our morning session at the University of Oregon Dental School, Merrill Swenson presented a very interesting discussion of occlusal grinding. This was followed by a question period in which a great deal of enthusiasm was taken. The second half of the morning Dr. W. S. Laughlin, of the University of Oregon Medical School, Department of Anthropology, gave an interesting discussion of applied anthropometrics. He went into quite a discussion of classification of human beings anthropometrically. It certainly is an allied science to dentistry of which we do not hear very much. It was the consensus of opinion that we would do well in our meetings to have a discussion of this type which is not pure orthodontics.

The afternoon session was taken up with a discussion of mixed dentition treatment. The speakers were E. Allen Bishop, Donald C. MacEwan, and Elwood Faxon. Don stressed that the orthodontists would do well to overcome the idea in the minds of the general dentists that we do not want to see prospective patients until they are 11 or 12.

On June 25, Chairman Arnold Stoller called the meeting to order and introduced first, Dr. John L. Ingle, of the University of Washington School of Dentistry, Seattle, who read a paper on "Occlusal Equilibration." He then introduced Arthur J. Corbett, of San Mateo, Calif., who spoke on "Hereditary Traits and Their Influence on the Development of an Individual's Personality.

Following this, E. Allen Bishop presented a Table Clinic demonstrating "Preliminary Treatment of Certain Class I Cases, also Certain Class II Cases Where There Is a Possibility of a Displaced Mandible."

CENTRAL SECTION

Our last quarterly meeting was canceled because of the Pacific Coast Society Convention held February 19, 20, and 21. A special meeting was called by Chairman Roy Cowden, for Tuesday, April 3, and was held at the Alexander Hamilton Hotel in San Francisco.

Members and guests present were: Members Arthur Skaife, Allen Scott, Reuben L. Blake, Seymore B. Gray, Ray A. Lussier, Arthur J. Corbett, Howard Jan, Lloyd M. Cox, Ernest Johnson, F. T. West, K. Terwilliger, Murry A. Bishop, Leland Carter, Wilfred Wong, William Smith, Cecil Rand, W. R. Campbell, Fred E. Havrilla, Walter J. Straub, C. W. Konigsberg, Raymond E. Brownell, Roy C. Cowden, Thos. R. Sweet, and J. Kester Diment.

The quarterly meeting was held Tuesday, June 12, 1951, at the Alexander Hamilton Hotel in San Francisco.

Fred West brought up the subject of inviting the A. A. O. Convention to the Pacific Coast in 1955, which has been considered by both the Northern and Southern Sections. Following discussion of the matter, it was moved, seconded, and unanimously voted to support either of the other sections chosen for the convention.

The meeting was turned over by Chairman Roy Cowden to Program Chairman Raymond Brownell, who introduced the speaker of the evening, Dr. Lowell N. Peterson, Periodontist, whose subject was, "Periodontal Conditions of Interest to the Orthodontists." It turned out to be a most interesting and enlightening presentation illustrated with Kodachrome slides.

Gingival conditions of patients who had had orthodontic treatment, as well as those which might have been avoided if the patient had been treated by an orthodontist, were presented and discussed. "Runners" have been observed by Dr. Peterson who has noted that they usually occur where the alveolar bone is extremely thin and soft tissue requires a good bony base for survival.

Program chairman, Ray Brownell, thanked Dr. Peterson for his presentation and the meeting was adjourned at 10 P.M.

CHARLES W. KONIGSBERG, Secretary-Treasurer.

SOUTHERN SECTION

The regular quarterly meeting was held at the Nikabob Cafe, 875 South Western Ave., Los Angeles, Calif., on Friday, June 8, 1951.

The social hour, dinner, and evening program was a joint meeting with Southern California Unit of American Society of Dentistry for Children.

It consisted of a panel discussion of questions of common interest to the orthodontist and pedodontist.

Moderator: A. L. Everett.

Panel members: H. V. Muehnic, D. R. McCauley, Jess Linn, C. F. S. Dillon, John Hopkins, and Fred McIntosh.

The discussion was confined to the general subjects of a list of questions previously submitted by members of the American Society of Dentistry for Children. It was thought that, in this manner, we could best answer on a group basis questions that nonorthodontists have in regard to causes, recognition, and prevention of malocclusion in the growing child. One hundred thirty members and guests of both groups attended dinner and the evening meeting.

Rocky Mountain Society of Orthodontists

The Rocky Mountain Society of Orthodontists will hold their annual fall meeting on November 5 and 6 in the Study Club Rooms of the Denver Dental Association at Denver General Hospital in Denver, Colo.

The program will include:

Andrew Francis Jackson, D.D.S., F.D.S.R.C.S.(Eng.), F.I.C.D., Philadelphia, Pa.

John T. Jacobs, M.D., Orthopedic Surgeon; Instructor, University of Colorado, College of Medicine, Denver, Colo.

A Motion Picture Study of Childhood Habits Which Affect Dental Occlusion and Facial Development. Courtesy of Kyrle W. Preis, D.D.S., F.A.C.D., Baltimore, Md.

Case reports by members.

Luncheon panel composed of Drs. Henry F. Hoffman, Wm. R. Humphrey, and J. Lyndon Carman, Moderator.

Pan American Odontological Association

A Plan for a Prize Essay Contest Among Undergraduate Dental Students

The Pan American Odontological Association announces a prize essay contest in 1951 among undergraduate students in the dental schools in North, Central, and South America. Each essay should be a discussion of ways to establish better Pan American relations in the dental profession, on a subject (title) to be selected by the author. An *award of one hundred dollars* will be paid to the author of the essay adjudged to be the most useful. That essay will be published in dental journals, after its presentation at the annual meeting of the Pan American Odontological Association in December, 1951. Each essay may be written in its author's mother tongue, under an assumed name, and presented to the dean of the dental school for transmission to Dr. J. A. Salzmann, 654 Madison Ave., New York 21, N. Y., for

receipt by him on or before Oct. 10, 1951. After selection of the prize essay, the dean of the school to which the essay is accredited will be requested to identify the author for payment to him of the award.

J. A. Salzmann, Chairman
William J. Gies,
Harry M. Seldin,
Committee on Prize Essay Contest.

The New Orleans Dental Conference

The Fourth Annual New Orleans Dental Conference will be held at the Roosevelt Hotel, New Orleans, Nov. 11, 12, 13, and 14, 1951.

Dr. M. R. Matta, Secretary,
629 Maison Blanche Bldg.,
New Orleans, La.

University of Indiana

The University of Indiana has announced a graduate course in orthodontics under the direction of Dr. J. W. Adams.

Emory University School of Dentistry

Emory University School of Dentistry, Atlanta, Ga., announces a twenty-four month teaching fellowship in orthodontics. Under this study program the Fellow devotes a minimal portion of his time to teaching, his major effort being directed toward guided studies in gross and microanatomy, histology, and pathology of the oral structures, growth and development, normal and abnormal occlusion, orthodontics, orthodontic technique, and clinical practice in orthodontics. In addition to these subjects, an intensive program in assigned library reading and research in the literature is provided; seminar sessions with the members of the staff are held on a regular schedule.

The Fellow is scheduled for a minimum of twelve hours a week in clinical practice; six in didactic subjects; eight in library research, assigned readings, and orthodontic laboratory techniques; and eight devoted exclusively to library research and studies in problems of concern to the specialist in orthodontics. In addition, he spends four hours a week with the staff of the Good Samaritan Clinic, where he attends staff seminars and discussion of cases, and assists in the treatment of patients suffering from various types of endocrine gland dysfunctions.

In this manner the Fellow engages in a well-rounded twenty-four month program of guided study, research, and practice which establishes a solid background for beginning the practice of the specialty. No degree is being granted at the present time, but certification of satisfactory completion of the course is given.

Federal Security Agency, Children's Bureau

Dr. Sarah S. Deitrick has been appointed to head the Children's Bureau international activities, Katharine F. Lenroot, Chief of the Children's Bureau, Federal Security Agency, announced today.

Dr. Deitrick formerly was Chief of the Field Operations Branch of the Division of Health Services. As director of the Bureau's Division of International Cooperation, she succeeds Mrs. Elisabeth Shirley Enochs who was named recently as Chief, International Technical Missions, in the Social Security Administration.

Surgeon General's Office Completes Hospital Management Workshop at Fitzsimons Army Hospital

The Office of the Surgeon General of the Army recently conducted a two-week workshop at Fitzsimons Army Hospital, Denver, Colo., to evaluate the progress made during the past year in hospital management improvement. This was the second course of this type to be held.

The first management course of this kind was held at Valley Forge Army Hospital last year for the purpose of indoctrinating a selected group of officers in the new organization and procedures developed at the test hospital. From this group were selected management officers and executive officers for large Army hospitals. During the past year all the Army's large named hospitals in the continental United States have been reorganized according to the new structure as outlined by the Surgeon General. Likewise, new procedures were implemented and local management improvement projects were initiated.

The new organization provides many new features but four of them are particularly significant:

1. A management office is established in each hospital as a staff element to assist the Commanding Officer in the execution of the Manpower Control, Fiscal, and Methods Improvement functions.
2. A nonprofessional, Medical Service Corps officer is provided the Commanding Officer to manage the administrative elements of the hospital with the title of Executive Officer.
3. A Medical Records, Reports, and Tabulating Division is established and equipped with electrical accounting machines to accomplish on a centralized basis all appropriate statistical and accounting operations.
4. A Women's Medical Specialist Corps officer (Dietitian) is assigned the complete responsibility for the management of the Food Service operation. Previously, a male officer was the manager and the dietitian was an advisor.

Continuous tests are in progress at Valley Forge Army Hospital, the Management Research Center for named Army hospitals. The Camp Atterbury Army Hospital has likewise been designated for projects peculiar to station hospitals. A pilot hospital has been selected in each Army area to initiate the implementation of the new organization developed for station hospitals.

Those in attendance at the workshop were unanimous in the feeling that a great deal of progress has been made. All those directly engaged in the Management Improvement Program of the Army Medical Service had an opportunity to bring themselves up to date on the over-all program and to exchange views and ideas with their co-workers.

Visitors participating included Mr. F. F. Fitzpatrick, Ford Motor Company; Mrs. Ann S. Friend, American Hospital Association; Mr. Hubert Hughes, Administrator, General Rose Memorial Hospital, Denver, Colo.; Lieutenant Colonel Carl R. Yost, Comptroller of the Army's Office; Colonel D. C. Tredennick and Lieutenant Colonel Earl H. Study, Office of the Assistant Chief of Staff G-4.

Notes of Interest

Dr. Roy B. Dean announces the association of Dr. Roberto M. Ruff in the exclusive practice of orthodontics, at Paseo de la Reforma 510-702, Mexico 6, D. F., Mexico.

Dr. James David McCoy announces the removal of his office from 405 North Bedford Drive, Beverly Hills, Calif., to 132 Lasky Drive, Beverly Hills, Calif., practice limited to orthodontics.

Dr. Faustin N. Weber, member of the staff of the division of operative dentistry and director of the postgraduate program in orthodontics at the University of Tennessee College of Dentistry in Memphis, has been promoted from associate professor to professor, according to an announcement by Dr. James T. Ginn, Dean of the school.

James E. Weesner, D.D.S., a four-year associate of Dr. Howard Yost, announces the opening of his office at 616 Sharp Bldg., Lincoln, Neb., practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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Pacific Coast Society of Orthodontists

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Southwestern Society of Orthodontists

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Secretary-Treasurer, Marion A. Flesher - - - Medical Arts Bldg., Oklahoma City, Okla.

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